SB

68-71

(FILE 3)

Example of a FERC Commission Order (Tyee)

Wakefield Carlson

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Georgiana Sheldon, Matthew Holden, Jr., and J. David Hughes.

Alaska Power Authority) Project No. 3015

ORDER ISSUING MAJOR LICENSE

(Issued August 5, 1981)

The Alaska Power Authority (APA) has filed an application for license for its proposed Tyee Lake Project No. 3015. The project would be located on Tyee Creek approximately 40 miles east-southeast of the City of Wrangell, Alaska near the head of Bradfield Canal and would occupy lands within the Tongass National Forest under the administratin of the United States Forest Service.

APA filed its application for license on December 19, 1979 and substantially revised it on September 8, 1980. The application was circulated for agency comment and given public notice. On February 26, 1980 the staff issued a Draft Environmental Impact Statement (DEIS) analyzing the proposed project. After reviewing the comments submitted on the DEIS and performing further analysis, the staff issued a Final Environmental Impact Statement (FEIS) on June 17, 1981.

Several agencies and groups have filed significant comments on the application and on the DEIS. Their concerns are addressed below. No one has filed a petition to intervene in the proceeding.

PROJECT DESIGN AND OPERATION

The Tyee Lake project would consist of: (1) Tyee Lake with a surface area of 434 acres at normal water surface elevation 1,396 feet mllw; 1/ (2) an intake structure at elevation 1,230 feet mllw; (3) an 8,300-foot long power tunnel; (4) a powerhouse containing two 10,000-kW generating units with provisions for a third unit; (5) a tailrace channel discharging into Airstrip Slough; (6) a switchyard adjacent to the powerhouse; and (7) a 42-mile long, 115-kV transmission system to the Wrangell Substation. There is no dam or spillway proposed as part of the project. A more detailed project description is contained in ordering paragraph (B).

1/ All elevations refer to mean lower low water (mllw) datum where mllw equals mean sea level minus 8.0 feet.

Except for a 400-kW and a 1,600-kW hydroelectric unit owned by the Petersburg Municipal Power and Light Company, the Wrangell-Petersburg areas power requirements are supplied by diesel units. The generating capacity of the proposed Tyee Lake Project, or additional capacity would be required to meet the forecast peak electric energy demand and reserve requirements of the area in 1987.

The Tyee Lake Project would be operated together with the existing hydroelectric units, to generate all the energy requirements of the Cities of Wrangell and Petersburg through the year 2000. 2/ Existing diesel capacity would be maintained to provide standby emergency capacity only. Tyee Lake Reservoir would have a potential operating range from elevations 1,396 to 1,250 feet, which would provide an active storage of 52,400 acre-feet. The reservoir would be operated to store runoff during the summer months and to release regulated flows for power generation throughout the year.

SAFETY AND ADEQUACY

Flows in excess of those that can be used by the generating units will pass through the natural outlet of Tyee Lake. The proposed 115-kV project transmission system leading from the Tyee Lake Powerhouse to the Wrangell Substation would have sufficient capacity to transmit the rated generating capacity of the project. The powerhouse would be founded on rock and would be safe against natural hazards of floods and earthquake.

An approximately 6,000-foot-long span of transmission line conductor would cross Eagle Bay along Bradfield Canal about 770 feet above the surface of the bay. APA reported that the Eagle Bay air corridor is actively used by aircraft in the region. An overhead span would therefore pose a potential hazard to aircraft from the Eagle Bay span. The Department of the Interior recommended that the overhead span not be used. APA stated that the span would be marked with brightly colored markers in accordance with Federal Aviation Administration guidelines and that announcements would be made describing this span and its location would be noted on air navigation charts. Any portion of the transmission line which presents hazards for aircraft should be made plainly visible and should comply with USFS requirements. Article 44 requires APA to conduct a study of the project transmission line including its effects on aircraft safety.

2/ The proposed project with its annual generation of 133,000 Mwh will utilize a renewable resource that will save the equivalent of approximately 245,500 barrels of oil per year.

It is concluded that the project under the conditions of this license, will be safe and adequate.

ECONOMIC FEASIBILITY

The 1984 on-line estimated cost of the project is $64,102,800. The cost of the proposed project was compared to various alternative sources of energy and is more fully described in the FEIS. Alternative sources included hydroelectric (sites other than Tyee Lake), diesel, and woodwaste steam electric. For the period after 1986, the proposed project is economically feasible when compared to diesel fueled generation, the Swan Lake hydroelectric alternative, and the woodwaste generation plant.

WATER QUALITY

Construction activities related to the project power tunnel, powerhouse, tailrace, switchyard, access roads, and construction camp would result in increased levels of suspended material and increased rates of sediment deposition in Airstrip Slough and to a lesser degree on the eastern end of Bradfield Canal. Article 41 requires APA to file with the Commission an erosion control plan. The plan must include an implementation schedule, a maintenance program, and evidence of agency consultation.

During initial project operations clearwater discharges ranging from 150 to 200 cfs from the powerhouse would result in scouring of the slough, which runs through wet lands in the vicinity of the powerhouse and tailrace. Scouring would continue, with consequent increases in the sediment load to Bradfield Canal, until a new equilibrium is established in the slough.

Airstrip Slough would also undergo changes in thermal characteristics. The low-level discharge from Tyee Lake, coupled with the much greater volume of flow from the tailrace in relation to the natural flow of the slough, would result in a drop in summer water temperatures and an increase in winter water temperatures. Considering the volume and exit temperature of the tailrace discharge ice-free conditions should be maintained in Airstrip Slough. Article 42 requires APA to conduct a study of the effects of the project construction and operation on the wetlands in the vicinity of the powerhouse and tailrace. The State of Alaska reviewed APA's application for a water quality certificate, found no evidence to suggest a significant adverse effect on waters of the United States and therefore decided not to act on the application.

FISHERIES

Operation of the project would result in the reduction or elimination of the Tyee Lake grayling population. The existing grayling population has not been utilized by the general fishing public, and thus has had little economic or recreational importance. Mitigative measures discussed by Staff in the FEIS include: (1) maintenance of the existing grayling population by artificial propagation and annual stocking, (2) maintenance of the existing population by manipulation of lake levels or other artificial methods to ensure fish access to spawning streams, or (3) transplantation of the population to another lake in the area.

The project would also result in losses to Tyee Creek salmon and trout populations due to a 92 percent reduction in the flows of the creek as measured at its outlet. Mitigative measures discussed by Staff include: (1) provisions for a minimum flow by diverting a portion of the powerhouse discharge into Tyee Creek, or (2) modification of Airstrip Slough, the tailrace structure, and the energy of the discharge to compensate for lost fishery habitat in Tyee Creek.

Article 43 requires APA to develop a plan to mitigate the effects of project operation on the fishery resources at Tyee Lake and Tyee Creek.

WILDLIFE

Disturbance and probable loss of wildlife would occur during construction of the project, especially in areas of transmission line corridor clearing. In-flight collisions of birds into the transmissions line would result in some bird mortality. Staff, however, believes that APA's proposed routing of the transmission line will satisfactorily minimize such in-flight collisions.

VISUAL RESOURCES

The presense of the project transmission line would result in the aesthetic degradation of visually sensitive areas. Clearing in areas of high visibility should be done in such a way as to minimize such adverse visual impacts. Towers, insulators, fencing, and substations should be dark and nonreflective. Structures, however, presenting hazards to aircraft should be plainly visible to the maximum extent possible. Article 44 requires APA to complete a study of transmission line facilities to minimize significant adverse impacts to the existing visual environment and aircraft safety.

FOREST RESOURCES

Construction of the project would result in the loss of approximately 490 acres of commercial forest land. In locating the final transmission line alignment, low or nonproductive timber sites should be used. The alignment should not preclude the opportunity for management of previously harvested timber lands and should be chosen to protect timber resources and allow for long sections of minimal or no clearing. Article 38 requires APA to file with the Commission a plan and implementation schedule for the collection and disposal of such timber.

CULTURAL RESOURCES

The project does not affect any sites included in or being considered for inclusion in the National Registry of National Landmarks on the National Register of Historic Places. APA has stated that it would avoid any known or newly discovered cultural properties during construction and operation of the project. The Alaska State Historic Preservation Officer (SHPO) concurs with APA's proposal. Article 40 requires that APA implement an acceptable cultural resources management plan for the project.

RECREATION

APA's recreation plan for the project proposes limited recreational facilities at the project powerhouse site. The U. S. Forest Service (USFS) which administers much of the land in the project area has stated that due to its inaccessibility, Tyee Lake and its surrounding area has limited potential for recreational development. USFS believes that other sites along the Bradfield Canal offer more potential for recreational development, but that current demands on the canal area are met by existing USFS facilities.

It appears that other project lands away from Tyee Lake along the transmission line corridor may be more suitable for development. Article 39, requires APA, following consultation with state agencies, to file a revised Exhibit R, if needed, describing any changes in proposed recreational development.

OTHER ENVIRONMENTAL CONSIDERATIONS

Both hydroelectric and nonhydroelectric alternatives to the proposed Tyee Lake Development were considered by the Commission's staff. The staff-developed alternative was found to be a viable hydroelectric alternative and a woodwaste generation plant was found to be a viable nonhydroelectric alternative.

The Swan Lake alternative is located on Thomas Bay about 16.5 air miles northeast of Petersburg. It would require a lake tap intake structure similar to that proposed at Tyee Lake and would require

18 miles of overhead and 4 miles of submarine transmission line from the project to Petersburg, plus 39 miles of transmission line between Petersburg and Wrangell. Unavoidable adverse construction impacts resulting from development of Swan Lake would be essentially equivalent to those described for the Tyee Lake Project. Development of Swan Lake, however, would result in the probable loss of recreational resources and the loss of an important rainbow trout fishery at Swan Lake. The Tyee Lake Project with appropriate mitigative measures would therefore be environmentally superior to the Swan Lake alternative.

A woodwaste generation alternative would probably be located near Wrangell and would require a 35-acre site. Air and water quality perturbations associated with woodwaste generation, however, could result in unacceptable levels of environmental disruption, considering the probable plant proximity to either Wrangell or Petersburg.

Considering all factors, we conclude that a Swan Lake hydroelectric plant or a woodwaste plant are inferior alternatives to the Tyee Lake project. We therefore find that licensing of the Tyee Lake Project is in the public interest.

OTHER ASPECTS OF COMPREHENSIVE DEVELOPMENT

The Tyee Lake project has the capability of using all the water entering Tyee Lake except occasional flood flows. The project would make good use of the waters of Tyee Lake, and would not conflict with any planned development. We conclude that the project, subject to the terms and conditions of this license, is best adapted to the comprehensive development of the basin under present conditions.

ANNUAL CHARGES

For the purpose of reimbursing the United States for the cost of administration of Part I of the Federal Power Act, APA is being assessed annual charges. The authorized installed capacity for this purpose is 26,700 horsepower. Additional charges are being assessed for the use and occupancy of federal lands. These charges are provided for in Article 33.

LICENSE TERM

The proposed Tyee Lake project is a major unconstructed project. In accordance with our usual policy this license will be issued for a term of 50 years, effective the first day of the month in which the license is issued.

The Commission orders:

(A) A license is issued to the Alaska Power Authority (Licensee) under Part I of the Federal Power Act (Act) for a period of 50 years, effective the first day of the month in which this license is issued, for the construction, operation, and maintenance of the Tyee Lake Project, FERC Project No. 3015, located on Tyee Creek approximately 40 miles from the City of Wrangell, Alaska. This license is subject to the terms and conditions of the Act, which is incorporated by reference as part of this license, and to the regulations the Commission issues under the provisions of the Act.

(B) The Tyee Lake Project consists of:

(i) All lands constituting the project area and enclosed by project boundary, to the extent of the Licensee's interests in those lands. The project area and the project boundary are generally described by the exhibits of the application for license as follows:

Exhibit	FERC Drawing No. 3015-	Titled
J-1	1	General Arrangement
J-2	2	General Arrangement
K-3	31	Transmission Corridor
K-4	32	Transmission Corridor
K-5	33	Transmission Corridor
K-6	34	Transmission Corridor
K-7	23	Tyee Lake

(ii) Project works consisting of: (1) Tyee Lake with a surface area of 434 acres and a usable storage capacity of 52,400 acre-feet between the natural surface elevation of 1,396 feet and a minimum surface elevation of 1,250 feet; (2) a power tunnel, approximately 8,300 feet long and 10 feet in diameter leading from an intake structure in Tyee Lake at elevation 1,230 feet to the powerhouse where it would trifurcate into 3 penstocks; (3) a surface powerhouse containing two 10,000-kW generating units with provisions for a third unit; (4) a 1,100-foot-long tailrace channel discharging into Airstrip Slough; (5) a 13.8/115-kV switchyard adjacent to the powerhouse; (6) a 115-kV transmission system consisting of 40 miles of overhead line and 2 miles of submarine cables, leading from the powerhouse switchyard to the Wrangell Substation; and (7) appurtenant facilities.

The location, nature and character of these project works is specifically shown and described by the exhibits cited above and more specifically described by the following exhibits.

Exhibit	FERC Drawing No. 3015-	Titled
L-1	24	Power Tunnel Profile and Sections
L-2	25	Power Tunnel Intake Structure
L-3	26	Powerhouse Site Plan
L-4	27	Powerhouse General Arrangement Plan
L-5	28	Powerhouse General Arrangement Sections
L-6	29	Powerhouse Switchyard General Arrangment
L-10	30	Reservoir Area & Capacity Curves

Exhibit M: Nine typewritten pages of text entitled "General Description of the Mechanical and Electrical Equipment, and the Transmission Line" filed on September 8, 1980.

Exhibit S: Fifteen typewritten pages of text and a 36 page appendix.

(iii) All of the structures, fixtures, equipments, or facilities used or useful in the maintenance and operation of the project and located in the project area, and any other property used or useful in connection with the project or any part of it; together with all riparian or other rights, the use or possession of which is necessary or appropriate in the maintenance or operation of the project.

(C) This license is subject to Articles 1 through 32 set forth in FERC Form L-2 (Revised October 1975) entitled "Terms and Conditions of the License for Unconstructed Major Project Affecting Lands of the United States," which are attached to and made a part of this license. This license is also subject to the following special conditions set forth as additional articles:

Article 33. The Licensee shall pay the United States the following annual charge, effective as of the first day of the month in which this license is issued:

(a) for the purpose of reimbursing the United States for the cost of administration of Part I of the Act, a reasonable annual charge as determined by the Commission in accordance with the provisions of its regulations, in effect from time to time. The authorized installed capacity for such purpose is 26,700 horsepower.

(b) for the purpose of recompensing the United States for the use, occupancy and enjoyment of its lands an amount to be determined later.

Article 34. The Licensee shall file with the Commission's Regional Engineer in San Francisco, California, and the Director, Office of Electric Power Regulation one copy each of the contract drawings and specifications for pertinent features of the project, such as water retention structures, powerhouse, and water conveyance structures, at least 30 days prior to the start of construction. The Director, Office of Electric Power Regulation may require changes in the plans and specifications to assure a safe and adequate project.

Article 35. The Licensee shall commence construction of the project within two years from the effective date of the license and shall thereafter in good faith and with due diligence prosecute such construction and shall complete construction of such project works within five years from the effective date of the license.

Article 36. The Licensee within 6 months following the date of commencement of operation of the project shall file a revised Exhibit F and, for approval, "as built" Exhibits J, K, and L to show the project as finally constructed and located.

Article 37. The Licensee shall retain a Board of three or more qualified, independent, engineering consultants to review the design, specifications, and construction of the project for safety and adequacy. The names and qualifications of the Board members shall be submitted to the Director, OEPR, for approval. Among other things, the board shall assess the geology; the design, specifications, and construction of the power tunnel, power tunnel intake, and powerhouse; electrical and mechanical equipment involved in water control and emergency power supply; instrumentation; the construction inspection program; and construction procedures and progress. The Licensee shall submit to the Commission copies of the Board's Report on each meeting. Reports reviewing each portion of the project shall be submitted prior to or simultaneously with the submission of the corresponding Exhibit L final design drawings. The Licensee shall also submit a final report of the Board upon completion of the project. The final report shall contain a statement indicating the Board's satisfaction with the construction, safety, and adequacy of the project structures.

Article 38. The Licensee shall, after consultation with the U.S. Forest Service and the Alaska Department of Public Health, and 30 days prior to beginning construction of the powerhouse, power tunnel, tailrace, and clearing of the transmission line right-of-way, develop and file with the Commission's Regional Engineer in San Francisco, and the Director, Office of Electric Power Regulation, a comprehensive plan for collection and disposal of sanitary and solid wastes to include, but not be limited to, excavated material and non-merchantable timber, during construction and operation of the project. The Director may require changes in the plan to protect the environment of the area.

Article 39. The Licensee shall consult with the U.S. Forest Service and the Alaska Department of Natural Resources concerning the need, if any, to revise plans for recreational development at the project. Licensee, within 1 year from the date of issuance of this license, shall file with the Commission the results of its consultation with the above agencies, and for approval a Revised Exhibit R, if needed, describing any changes in the proposed recreational development for the project.

Article 40. The Licensee, at least 60 days prior to any ground-disturbing activity at the project, shall file a cultural resource management plan for Commission review that describes: (1) procedures which would be employed to avoid impacts to archeological and historic sites; and (2) the monitoring program to avoid and mitigate impacts at direct impact areas which have been noted as having potential for subsurface archeological deposits. This plan should be site-specific, and be prepared in consultation with the Alaska State Historic Preservation Officer (SHPO). If any previously unrecorded archeological or historic sites are discovered during the course of construction or development of any project works or other facilities at the project, construction activity in the vicinity shall be halted, a qualified archeologist shall be consulted to determine the significance of the sites, and the Licensee shall consult with the SHPO to develop a management plan for protection of significant archeological or historical resources. If the Licensee and the SHPO cannot agree on the amount of money to be expended on archeological or historical work related to the project, the Commission reserves the right to require the Licensee to conduct, at its own expense, any such work found necessary.

Article 41. The Licensee, in consultation with the U.S. Forest Service, the Alaska Department of Fish and Game, and the U.S. Army Corps of Engineers, shall prepare and file with the Commission's Regional Engineer in San Francisco, California, and the Director, Office of Electric Power Regulation, at least 30 days prior to any ground disturbing activity or spoil disposal, a detailed plan to control soil erosion, dust, and slope stability, and to minimize the quantity of inorganic sediment or other potential water pollutants resulting from construction

and operation of project facilities. This plan shall include an implementation schedule, maintenance program, and evidence of agency consultation. The Director, Office of Electric Power Regulation, may require changes in the plan to minimize erosion, dust, sedimentation, water pollution, or slope stability problems.

Article 42. The Licensee, in consultation with the Alaska Department of Fish and Game, the U.S. Forest Service, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service, shall develop a plan to minimize effects of project construction and operation on the wetlands in the vicinity of the proposed powerhouse and tailrace. The Licensee, at least 60 days prior to any ground-disturbing activities in the wetlands, shall file this plan with the Commission along with comments on the plan by the consulted agencies.

Article 43. The Licensee, in consultation with the Alaska Department of Fish and Game, the U.S. Forest Service, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service, shall develop a plan to mitigate the effects of project operation on the fishery resources of Tyee Lake and Tyee Creek. This plan shall include recommendations regarding mitigation of loss to the Tyee Lake Arctic grayling population, to include the practicality and cost of establishing a grayling population in another lake in the area, and recommendations regarding the most practical and effective means of mitigating the loss of fishery resources in Tyee Creek, downstream of the falls, to include possible use of the tailrace or Airstrip Slough as replacement fishery habitat. Licensee, within 1 year from the date of issuance of this license, shall file this plan with the Commission for approval, along with comments on the plan by the consulted agencies.

Article 44. The Licensee, within six months from the date of issuance of this license, and in consultation with the Supervisor, Tongass National Forest of the U.S. Forest Service, the Federal Aviation Administration, and the Alaska Department of Transportation and Public Facilities, shall complete a study of the location, design, construction and maintenance procedures of all transmission line facilities, including rights-of-way, submarine cable terminals, and high aerial crossings, to include the crossing over Eagles Bay on Bradfield Canal, and near the Orion Triangulation Station on Eastern Passage. That study shall address the need to prevent, or minimize to the extent possible, significant adverse impacts to the existing visual environment and aircraft safety. Licensee, within six months from the date of issuance of this license, shall file a report on the results of that study, to include documentation of consultation and subsequent recommnedation. The Commission reserves the right to require modification of transmission line facilities with regard to visual resources and aircraft safety.

Article 45. (a) In accordance with the provisions of this article, the Licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain other types of use and occupancy, without prior Commission approval. The Licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the Licensee shall also have continuing responsibility to supervise and control the uses and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the Licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the Licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, cancelling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The types of use and occupancy of project lands and waters for which the Licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities; and (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the Licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The Licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the uses and occupancies for which it grants permission are maintained in good repair and comply with applicable State and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the Licensee shall: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the reservoir shoreline. To implement this paragraph (b), the Licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the Licensee's costs of administering the permit program. The Commission reserves the right to require the Licensee to file a description of its

standards, guidelines, and procedures for implementing this paragraph (b) and to require modifications of those standards, guidelines, or procedures.

(c) The Licensee may convey easements or rights-of-way across, or leases of, project lands for: (1) replacement expansion, realignment, or maintenance of bridges and roads for which all necessary State and Federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir. No later than January 31 of each year, the Licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The Licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary State and Federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary Federal and State water quality certificates or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary Federal and State approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 watercraft at a time and are located at least one-half mile from any other private or public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from the edge of the project reservoir at normal maximum surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 45 days before conveying any interest in project lands under this paragraph (d), the Licensee must file a letter to the Director, Office of Electric Power Regulation, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G or K map may be used), the nature of the proposed use, the identity of any Federal

or State agency official consulted, and any Federal or State approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the Licensee to file an application for prior approval, the Licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraphs (c) or (d) of this article:

(1) Before conveying the interest, the Licensee shall consult with Federal and State fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the Licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved Exhibit R or approved report on recreational resources of an Exhibit E; or, if the project does not have an approved Exhibit R or approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include covenants running with the land adequate to ensure that: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; and (ii) the grantee shall take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project.

(4) The Commission reserves the right to require the Licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G or K drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic

values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised Exhibit G or K drawings would be filed for approval for other purposes.

(D) This order is final unless an application for rehearing is filed within 30 days from the date of its issuance, as provided in Section 313(a) of the Act. The filing of an application for rehearing does not operate as a stay of the effective date of this license or of any other date specified in this order, except as specifically ordered by the Commission. Failure of the Licensee to file an application for rehearing shall constitute acceptance of this license. In acknowledgment of acceptance of this license, the license shall be signed for the Licensee and returned to the Commission within 60 days from the date of issuance of this order.

By the Commission.

(S E A L)

Kenneth F. Plumb
Kenneth F. Plumb,
Secretary.

IN TESTIMONY of its acknowledgment of acceptance of all of the terms and conditions of this order, Alaska Power Authority this _____ day of _____, 1981, has caused its corporate name to be signed hereto by _____ its _____ Director, and its corporate seal to be affixed hereto and attested by _____ its, _____ Secretary, pursuant to a resolution of its Board of Directors duly adopted on the _____ day of _____, 19 __, a certified copy of the record of which is attached hereto.

Alaska Power Authority

By _____
Director

Attest:

_____
Secretary

MEMORANDUM State of Alaska

TO: Gordon Harrison
Associate Director
Office of Management and Budget
Division of Strategic Planning

DATE: February 23, 1983

FILE NO:

TELEPHONE NO: 465-3573

FROM: George Matz GM
Division of Strategic Planning
Office of Management and Budget

SUBJECT: Tyee Lake Project

There has been controversy recently regarding the Tyee Lake Project. The City of Petersburg has stated that the cost of power from the project is too expensive and they may not want to sign a power sales contract under the terms initially proposed by the Alaska Power Authority (APA). This situation has lead to an examination of other questions including the projects economic feasibility and the process by which this is determined. The purpose of this memo is to provide an historical perspective on the question of economic feasibility. The information in this memo should supplement rather than duplicate information in a February 9, 1983 memo from Eric Yould to Jack Kreinheder and a February 11, 1983 memo from Jack Kreinheder to Representative Don Clocksin.

The feasibility study for the Tyee Lake Project was completed for the APA in December of 1979. The statute at this time (AS 44.56.180) required the Office of the Governor to evaluate APA feasibility studies. Since the APA was in its infancy and the Tyee Lake Project was its first project to have completed a feasibility study, no formal review was undertaken.

In 1980, the Legislature passed an omnibus energy bill (Ch 83, SLA 1980) which amended requirements for APA reconnaissance and feasibility studies. This bill also requires the Division of Budget and Management (now Office of Management and Budget) to review these studies for statutory compliance and provide a recommendation to the Governor and the Legislature for feasibility studies. However, certain projects, including the Tyee Lake Project, had been previously approved by the Legislature and were exempted from review by the Division of Budget and Management. House Joint Resolution No. 62, which had been approved by the Legislature earlier in the 1980 session, stated that the general design of the Tyee Lake Project was approved and that the APA could incur $70,000,000 in revenue bond indebtedness to finance the project.

In 1981, the Legislature once again made significant amendments to the APA statutes (Ch 118, SLA 1981). One of the more significant amendments established a Power Development Fund to be used primarily for financing construction of State owned power projects. Restrictions were placed on the use of this fund. One of these restrictions (AS 44.83.394) states that "the authority may not use money in the fund for a power project except in compliance with AS 44.83.177-44.83.187 and unless the authority determines that the project is economically feasible."

Ch 90, SLA 1981 (which was the appropriation bill which accompanied Ch 118, SLA 1981) made appropriations to begin construction on three power projects. These projects, and the amount of their respective appropriations are Tyee Lake Project - $48,000,000, Swan Lake Project - $53,000,000, and the Terror Lake Project $81,500,000. Additional appropriations in the form of a loan, had previously been made to each of these projects. These loans were converted to grants by another bill Ch 91, SLA 1981.

Although each of these projects had completed feasibility studies and received legislative approval, AS 44.83.394 required a final review of the economic feasibilty of each project before the APA could make expenditures from the Power Development Fund. The statutes are not specific as to how the economic feasibility should be determined. The APA assumed that the feasibility assessment should be treated as an updated supplement to previous feasibility studies rather than repeat the entire process.

Apparently, the APA's first attempt at complying with AS 44.83.394 was an August 13, 1981 memo from Robert Mohn, Director of Engineering to the Record (see Attachment A). The information in this memo was presented to the August 18, 1981 meeting of the APA Board of Directors to demonstrate that even with more recent and higher construction cost estimates, the Tyee Lake Project was economically feasible at the "most likely" load growth rates. Following this presentation, the Board was asked to approve the award of construction contracts which would obligate funds in the Power Development Fund. It should be noted that this was the first meeting of a newly appointed Board of Directors and not all of the Board members were familiar with statutory requirements for power projects.

Ron Lehr, a Board member and Director of Budget and Management at that time, questioned some of the points used in the presentation and requested backup information. This information was sent to Budget and Mangement where staff found the information inadequate to make a determination regarding the economic feasibility of the Tyee Lake Project. APA staff was informed of this and responded in a September 10, 1981 letter with copies of the calculations used for the August 13, 1981 memo.

Budget and Management staff reviewed these calculations, found some technical errors, and requested that corrections be made in the analysis. Apparently, the request led to a decision by the APA to provide a more complete and adequate explanation of the economic feasibility of the project. The product of this effort was a "Findings and Recommendations" report that was completed on December 2, 1981 and distributed to the Board at its December meeting. This report fully explained the assumptions that were being used and provided enough details to review the economic feasibility of the project.

Although a review by Budget and Management of the "Findings and Recommendations" report was not required by statute, a review was undertaken for the benefit of Ron Lehr who's interest was both as a Board member and State Budget Director. Ron Lehr distributed this review to the Board at its January, 1982 meeting.

The Budget and Management review (Attachment B) questioned several assumptions and calculations used in the "Findings and Recommendations" report. The conclusion of the review is that the Tyee Lake Project may not be economically feasible based on the "most likely" load forecast but should be economically feasible if the actual load should exceed the "most likely" load forecast. Some of the more significant points brought out in the review are given below.

1) ✓ If and When - The economic feasibility analysis of a power project, particularly projects having a long life such as hydro power, should not only determine "if" the project is feasible but "when" is the most economic time to begin construction. A timing exercise of this nature was not done for the Tyee Lake Project even though such an exercise is most applicable to projects which have initial overcapacity, such as the Tyee Lake Project.

2) Reserve Capacity - Neither this economic analysis or cost of power calculation considered the cost of reserve capacity.

3) Load Forecast - The base year for the load forecast was higher than actual data. Also, the load forecast assumed an increase in electric space heating even though fuel oil appears to be a less expensive alternative.

4) Alternative - A number of smaller and less remote hydroelectric alternatives were not given detailed consideration. U.S. Army Corps of Engineers data indicates that some of these projects could have lower power costs than the Tyee Lake Project. Also, since all of the projects were smaller, overcapacity would not be a significant problem.

The load forecast in the most significant and perhaps the most uncertain parameter which applies to the economic feasibility of the Tyee Lake Project. Since the load forecasts were made a few years ago, we now have the benefit of hindsight to assess the accuracy of the first few years of the forecast. This information is presented below based on the "most likely" forecast for the "Findings and Recommendations" report and the "expected" forecast for the Feasibility Study. The Feasibility Study used 1978 as the last year of actual data. Neither of these forecasts, as presented, subtract out approximately 11,700 MWh of annual generation from an existing hydroelectric facility near Petersburg.

Energy Sales (MWh) for Wrangell and Petersburg

Year	Actual	Findings and Recommendations Report	Feasibility Study
1978	29,981	---	29,981
1979	29,087	---	31,445
1980	29,788	30,535	32,990
1981	29,222	31,726	35,275
1982	30,985	32,963	37,710

In summary, commitments to the Tyee Lake Project have been slightly ahead of establishing a more rigorous process for assessing the economic feasibility of proposed APA projects. Specifically:

1) the feasibility study for the project was completed before an independent review process was firmly established by the Legislature;

2) the Legislature approved the project without benefit of an independent cost analysis as now required by statute; and

3) construction contracts had been awarded before the "Findings and Recommendations" report had been completed and before the provisions of AS 44.83.394 has been met.

ALASKA POWER AUTHORITY

Attachment A

Memo to: Ron Lehr
Director
Division of Budget and Management

Date: August 20, 1981

From: Robert Mohn
Director of Engineering
Alaska Power Authority

Subject: Tyee Hydroelectric Project

The attached information is being provided in response to your request at the Board of Directors meeting on August 18.

Fuel costs were projected per APA standard procedures, except that the analyst erred by escalating for 20 years from the power-on-line date instead of from today. An extra 3 years of escalation is therefore included under the ~~13.5~~ 3.5 and 7 percent escalation scenarios.

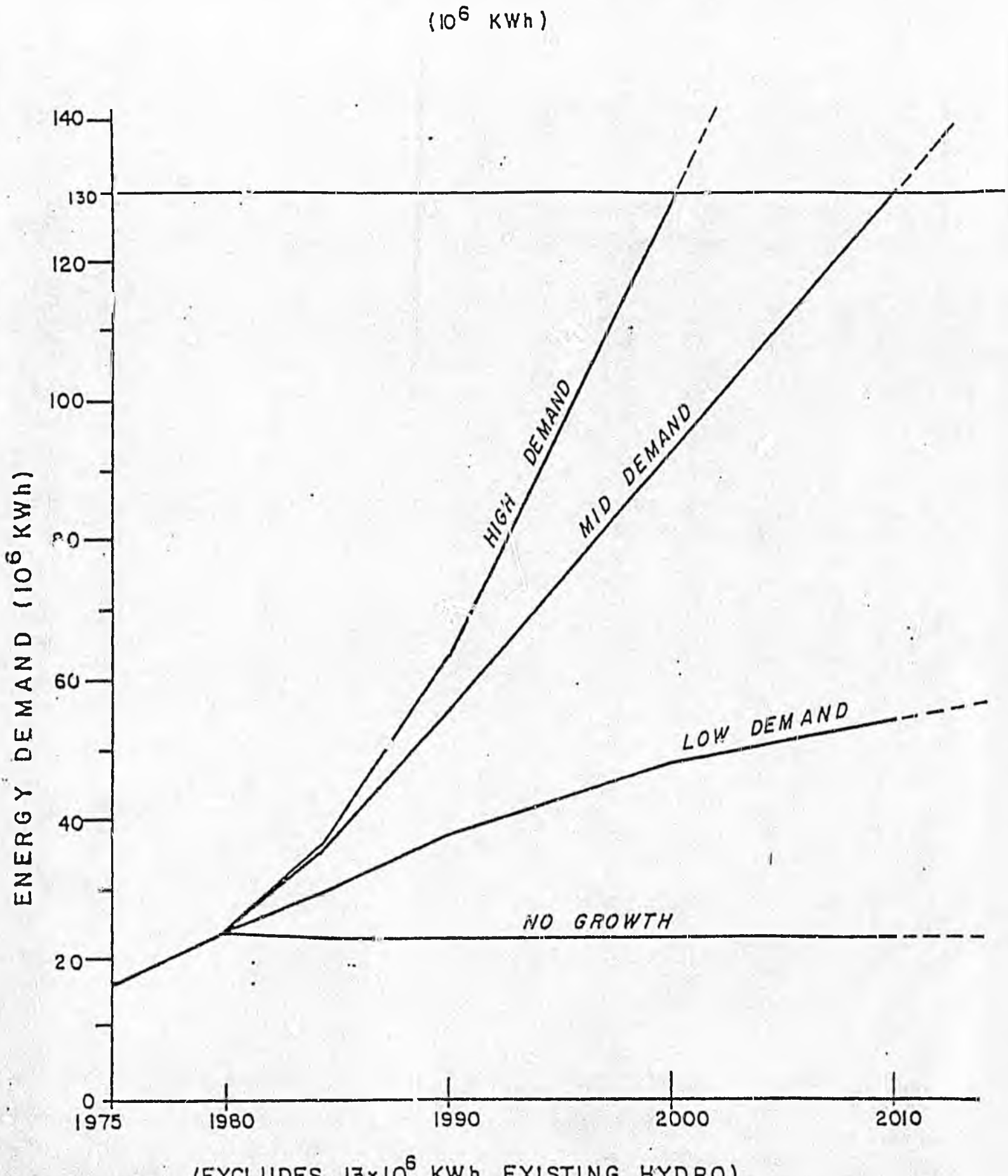
Project utilization was projected according to the indicated load growth rates.

Yearly cost of fuel displaced was calculated and then discounted at 3 percent to the present. This was done for 12 cases (3 escalation scenarios, 4 utilization scenarios).

The discounted total cost in each case was adjusted downward by 6 percent to account for interest during construction. In other words, the discounted total fuel cost is equivalent to the maximum permitted hydro investment cost; the permitted construction cost is investment cost less interest during construction (IDC @ 3% for 2 years = 6%).

TYEE PROJECT

DEMAND SCENARIOS



MEMO TO: The Record

DATE: August 13, 1981

FROM: Robert A. Mohn RAM
Director of Engineering

SUBJECT: Economic Feasibility Sensitivity Analysis

{138,700 Btu/gal.
{10,500 Btu/kwh
Conversion Table
Long Term Energy Plan

1. Assumptions: 13.1

Heat rate 12.6 kwh/gallon
August 3, 1981 fuel prices

$1.08)
$1.13) say 1.10/gal 8.4

Energy cost = 1.10/12.6 = 8.7¢/kwh
Fuel displacement cost only

2. Fuel escalation:

0, 3.5 and 7 percent escalation

3. Load growth:

Tyee is assumed to provide total required generation less existing hydro generation of 13,000,000 kwh. Four cases are examined: no growth, low growth, mid growth, and high growth.

AVERAGE ANNUAL COMPOUND GROWTH RATES (%)

Period	Historical Growth	No Growth	Low	Expected	High
60-65	8.1				
65-70	7.4				
70-75	6.8				
75-80	4.9				
80-85		0	3.9	6.6	7.6
85-90		0	3.0	6.7	7.6
90-95		0	1.8	4.3	7.6
Beyond 95		0	1.4	4.0	7.6
LONG-TERM EQUIVALENT RATE:		0	2.5	5.9	7.6

4. Period of analysis:

50 years

BEST ESTIMATE # OF [illegible]: $105-110 \times 10^6$

of ALASKA

Attachment B

TO: Ronald D. Lehr, Director
Division of Budget and Management
Office of the Governor

DATE: January 12, 1982

FILE NO:

TELEPHONE NO:

FROM: George Matt, Program Analyst
Division of Budget and Management
Office of the Governor

SUBJECT: Tyee Lake Project - Findings and Recommendations Report

According to statute*, power projects which receive funding from the Power Development Fund must demonstrate economic feasibility and be able to provide the State with a 5% annual rate of return before these funds can be expended. Economic feasibility is not defined but existing practice determines feasibility by comparing the cost of the project with the cost of the base case. Benefits, such as waste heat utilization, are deducted from project costs. Such a determination is often called a benefit-to-cost ratio but it is actually a cost-to-cost ratio. Although the statutes require a 5% return calculation, the significance of these calculations is not clear. Presumably, an acceptable rate of return for a project results in lower cost power than the base case.

At the August meeting of the APA board of directors, the APA staff presented information which meant to satisfy the economic feasibility requirement. Since the information was cursory, you requested further details. On August 20, 1981, Robert Mohn sent you a memo and an assortment of calculations. (Attachment A) These calculations were reviewed by Budget and Management staff which found the report inconclusive because of some errors and omissions The APA staff agreed to improve the report.

On December 13, 1981, Robert Mohn delivered to Budget and Management a copy of "Tyee Lake Hydroelectric Project Findings and Recommendations" which was also included in the packet for the December board meeting. This report clearly presents the assumptions and rational for all calculations. The report concludes that:

1. The Tyee Lake Project is economically feasible but "sensitive to load growth projection, the results are also sensitive to the estimated cost (primarily fuel escalation) of the diesel alternative". Any further increases in construction costs would also effect the projects economic feasibility. The cost/cost for the most likely demand scenario (which is greater than recent demand) is given as 1.1 (it actually calculates as 1.07). If there is significant conversion to electric space heating, the cost/cost is expected to be 2.0 (actually its 2.01).

* These requirements are in AS 44.83.394 (formerly AS 44.83.470).

2. Although a 5% rate of return on the Tyee Lake Project would result in more expensive power for the first few years of operation, diesel generation would soon become more expensive. Over the life of the Tyee Lake Project, a 5% rate of return would be less expensive than projected diesel generation costs. However, the significance of this determination is unclear, particularly since subsidized costs are being compared to unsubsidized costs.

Budget and Management's review of the findings and recommendation report found a major deficiency in the report relative to the timing of project construction and several minor deficiencies regarding costs. The cost deficiencies are significant for the most likely demand scenario, because of the closeness in costs for the Tyee Lake Project and the base case, but are not significant for demand scenarios having a greater growth rate. Listed below are these deficiencies followed by a recalculation of the costs and some recommendations.

1. If and When - An economic feasibility determination for power projects, particularly projects having a long life such as hydropower, should provide sufficient information to indicate "if" the project is feasible and, if so, "when" is the most economic time to start construction. The report calculates "if" the Tyee Lake Project is economically feasible but does not include the calculations needed to determine "when". To determine "when" requires a comparison between the Tyee Lake Project and the base case of the accumulated annual present costs. This comparison requires that the capital costs of a project be discounted from the year that the costs are incurred rather than amortization of the costs. The report discounts the cost of the Tyee Lake Project from the year that costs were incurred but amortizes the capital costs for diesel generation. The report does provide an annual comparison of the cost of power but this financial feasibility data should not be confused with economic feasibility data.

2. Reserve Capacity - The cost of power forecast assumptions state that the "reserve capacity requirement is equal to the largest unit in each community" but these costs are not included in the present cost (present worth) or the cost of power calculations for either the Tyee Lake Project or the diesel base case.

With the Tyee Lake Project, as with the Snettisham Project, the reserve capacity should equal only the lesser of the peak demand or the Tyee Lake Project (the largest unit). The least cost reserve capacity system is Petersburg's and Wrangell's existing diesel/hydro system. The costs for this system includes; 1) capital costs for expansion and replacement of diesel generators, 2) operation and maintenance (O&M costs) and 3) fuel costs. AEL&P in Juneau uses diesel for about 1% of their net generation.

The base case already includes more than adequate reserve capacity. Therefore, assuming the most likely demand scenario, no additional costs for reserve capacity would be needed for a number of years. However, some additional costs would probably be incurred to maintain the reserve capacity in operating condition. Fuel costs for reserve capacity would not be much different than the fuel costs already included.

3. Waste Heat - The report allows waste heat credits for Petersburg's diesel system but not for Wrangell's diesel system. Although Wrangell's diesel generators are not as centrally located, it does not seem reasonable to exclude any benefits for waste heat. Even if a district heating systems is not economically feasible, waste heat could still be beneficially used for: 1) in-plant use, 2) water heating or 3) cogeneration. The report does not appear to devote as much emphasis to the utilization of waste heat as it does to the utilization of Tyee Lake Project surplus capacity.

The capital costs for waste heat exchangers were amortized using a 3% interest rate and 10 year economic life. This is inconsistent with the present cost calculations for the Tyee Lake Project and can underestimate the cost of waste heat systems. The full cost of the system should be applied to the year in which the costs are incurred.

Cost of power forecasts do not include waste heat benefits.

4. Demand Projections - The report used 1980 as the base year. The data for 1980 total generation and energy sales is not consistent with data in Alaska Electric Power Statistics 1960-1980, as shown below:

	Total Generation	Energy Sales
Findings and Recommendations	33,335 MWH	30,535 MWH
Alaska Electric Power Statistics	32,869 MWH	29,788 MWH
Difference	- 1.4%	- 2.5%

Also, the report states that the energy growth rate for Wrangell and Petersburg, during the last five years, has been 3.6%,

5. Space Heating - Although the feasibility study considers Case D demand projections as the scenario which represents conversion from fuel oil to electricity for space heating, the report favors Case C as the scenario which includes electric space heating. The difference between Case B (the most likely scenario without much electric space heating) and Case C represents about 45% of the total potential for electric space heating in 1990 and nearly 100% of the potential by 2,000. For Case C, about half of the energy demand in 2,000 would be for space heating.

Exhibit 21 shows that, in 1984, the equivalent price of heating with fuel oil is approximately the same as the wholesale price (not cost) of electricity assuming only the O and M costs for the Tyee Lake Project and not the conversion costs. However, the price of fuel oil increases more rapidly than the wholesale price of electricity and becomes significantly more expensive in following years. Despite this differential there is reason to doubt whether the demand for electric space heating will be significant. Reasons for doubt include:

a. The report considers that the cost of conversion from oil furnaces to electric heating is insignificant. This cost can amount to several hundred dollars for simple resistance heating to several thousand dollars for more efficient heat pumps. Including these costs could delay the time when electric space heating is more economical.

b. As Juneau is realizing, electric space heating increases peak demand and the cost of reserve capacity. A utility can moderate peak loads with demand charges but this erodes some of the price advantage that electric space heating may have.

c. It is inaccurate to compare the market price for fuel oil with the wholesale price for electricity. The wholesale price does not include distribution costs, overhead, etc. Including these costs increases the price at which substitution is likely.

d. If the State decides to recover the principal or receive an actual rate of return from its investment in hydroelectric projects, electric space heating would not have a price advantage for several more years.

e. Although the State uses a fuel escalation rate of 2.6% for its power project economic feasibility calculations, any near term real price increases in fuel oil seems unlikely. This in effect, delays the time that substitution would occur and reduces the overall demand.

f. It is reasonable to expect that a substantial portion of Wrangell's and Petersburg's space heating needs will continue to be met by wood.

6. Losses - The report assumes that non-revenue uses and line losses will be 8.5% for both the Tyee Lake Project and the base case (diesel). Although this assumption may be a reasonable short cut, it would be more accurate to calculate each alternative separately since they are not similar situations. Transmission line losses will be higher for the Tyee Lake Project but in-plant use (non-revenue uses) will be higher for diesel generators. Also, the feasibility study lists recent non-revenue uses and losses above 12% but indicates that there has been a trend towards more efficient operation.

In a related matter, the report assumes 12.6 kwh/gallon of fuel oil for diesel generation. This is less efficient than typical heat rates cited by other sources. For instance, the Battelle Railbelt Electrical Power Alternatives study states that "typical heat rates of relatively modern diesels in the Railbelt are about 10,500 BTU/kwh" which converts to 13.2 kwh/gal. "Very large, slow speed units have achieved heat rates of 5,550-9,700 BTU/kwh" which converts to 16.2 kwh/gal and 14.3 kwh/gal respectively. On the other hand, according to Alaska Electric Power Statistics 1960-1980, in 1980, Wrangell and Petersburg used 1,732,000 gallons of fuel oil to generate 21,210,000 kwh which is equivalent to 12.3 kwh/gal.

7. Comparison to other projects - The first draft of the report included data which compared the Tyee Lake Project to other potential hydroelectric projects in the Petersburg and Wrangell area. The comparisons presented the cost of power in the year 2,000 (using Corps of Engineer construction cost estimates) for several projected demand growth rates. Listed below are those projects which appear to be less expensive than the Tyee Lake Project at the low growth rate which is the rate that most closely resembles the recent actual growth rate.

Project	Cost
Tyee Lake	7.4¢/kwh
Virginia	4.9¢/kwh
Goat Creek	4.8¢/kwh
Sunrise	3.9¢/kwh
Scenary	3.9¢/kwh
Olive Creek	3.8$/kwh

Another hydroelectric project which the APA and Petersburg were considering before commitment to the Tyee Lake Project, is the City Creek Project. This 700 kw project could generate 2,830 kwh at a cost of 3.9¢/kwh (1979 estimate).

Attachment B provides information regarding the size of some of these projects.

Although the accuracy of the costs for these projects can be questioned, the APA contends that the assumptions are relatively consistent, therefore, the relative costs are somewhat consistent.

8. Cost of Power - The report emphasizes the cost of power for various projects and finance plans. It needs to be realized that 1) this data should not be used to compare the economic feasibility of alternatives, 2) the cost of power is not the cost to the consumer but the wholesale price and 3) all of the Tyee Lake Project finance plans include a substantial amount of State subsidy but the diesel alternative calculations do not include a comparable level of subsidy or existing subsidy programs such as Power Cost Assistance.

The O&M costs for the Tyee Lake cost of power calculations are inflated at 5.4% annually while the O&M costs for diesel generation are inflated at 7% annually. Consequently, exhibits 45 and 46 are inaccurate.

The fuel costs for diesel generation are based on adjusted sales rather than net generation. Consequently, the fuel costs for line losses and in-plant use (8.5% of net generation) are not included in the calculations or exhibits.

Since the economic feasibility calculations did not appear to be as accurate as is possible, the present costs were redone. Key differences between these calculations and the report are:

1. Capital costs were not amortized but are discounted from the year that the costs are incurred.

2. The Tyee Lake Project includes costs for reserve capacity. This includes $100,000 per year for O&M and fuel costs equivalent to 1% of net generation by diesel. No capital costs for diesel are included since the projected peak demand does not exceed existing capacity and no retirement is assumed.

3. Case B was used to determine the energy demand and consequently, O&M and fuel costs. The base year, 1980, was adjusted to coincide with actual data.

4. The fuel escalation rate was 2.6%.

Costs or cost offsets which were not included in the revised calculations but could affect the economic feasibility of the Tyee Lake Project, are:

1. Adjusted generation (net generation less 11,659 MWH provided by an existing hydroelectric project near Petersburg) increased by the growth rate until the year 2000. This is consistent with APA regulations for calculating economic feasibility. However, the adjusted generation for the year 2,000 is 42,252 MWH which is a fraction of the capacity of the Tyee Lake Project (130,000 MWH). If the demand were to continue to increase after 2000 it would not significantly change the present cost of the Tyee Lake Project but would increase the present cost of diesel generation.

2. Adjusting generation to account for the existing 1600 kW hydroelectric project in Petersburg continues throughout the 50 year economic life of the Tyee Lake Project. However, the existing hydroelectric project was installed in 1956 and, obviously, has a shorter economic life.

3. The full value of waste heat utilization was not included in the calculations. The APA reduced the benefits of Petersburg waste heat by 30% because of seasonal load diversity. Also, Wrangell which has about twice the waste heat potential of Petersburg was not included. If nearly all of the potential were utilized, the cost of diesel generation could be substantially lower.

The results of the revised calculations using a 50 year period are:

Project	Present Cost
Tyee Lake	$134,226,000
Diesel Generation (with Petersburg waste heat)	$127,309,000
Diesel Generation (without waste heat)	$148,043,000

The Cost/Cost Ratios Are:

Diesel with waste heat/Tyee	-	.95
Diesel w/o waste heat/Tyee	-	1.10

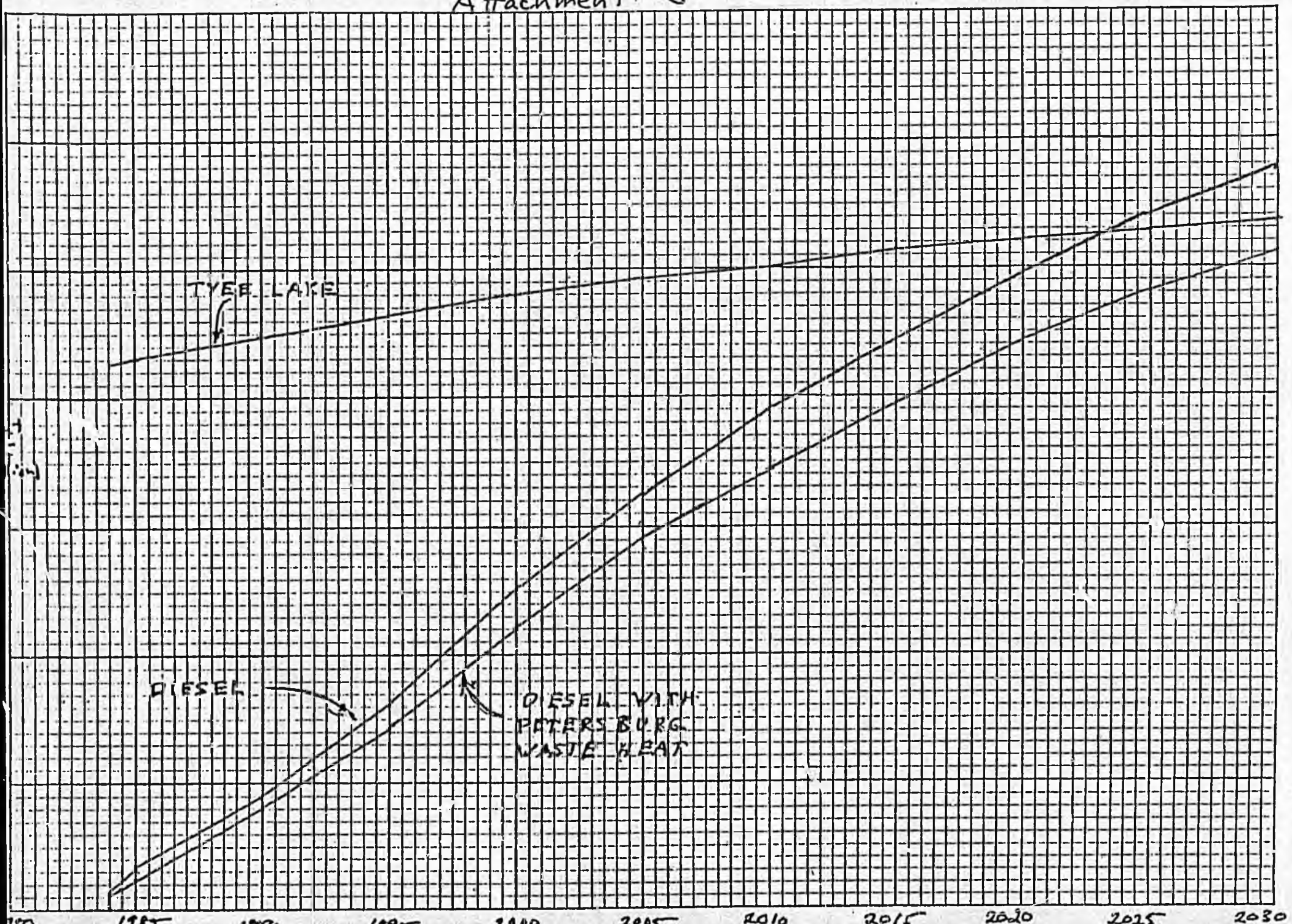
The present costs were accumulated on an annual basis in order to indicate approximately "when" a project become economically feasible. Attachment C is a graph which portrays the annual accumulated present costs of the Tyee Lake Project and diesel generation, with and without waste heat utilization.

Table 3.1*

SOUTHEASTERN UNDEVELOPED HYDROELECTRIC SITES

Area/Project	Capacity (KW) Installed	Capacity (KW) Prime	Prime Energy (MWH)	Total (000$)	Capital Cost Per* Prime KW	Capital Cost Per* Installed KW
Southeast						
Metlakatla						
Purple Lake						
Rehabilitation	1,400	400	17,520	1,134	2,835	810
Hassler Lake	4,000	2,000	16,980	6,830	3,415	3,415
Total	5,400	2,400	34,500			
Ketchikan						
Upper Mahoney Lake	10,000	4,700	41,172	9,035	1.772	903
Swan Lake	15,000	7,700	67,500	32,980	4,283	2,199
Lake Grace	20,000	11,000	94,000	39,351	3,577	1,960
Total	45,000	23,800	202,672			
Petersburg-Wrangell						
Anita	4,000	2,100	18,395	5,871	2,796	1,458
Anita and Kunk Lakes	8,000	3,830	33,550	9,120	2,383	1,141
Virginia Lake	6,000	3,000	26,200	7,070	2,357	1,178
Sunrise Lake	4,000	2,400	21,024	4,174	1,739	1,043
Ruth Lake	16,000	7,950	69,660	23,355	2,938	1,460
Crystal Lake Expansion	2,500	400	3,504	4,400	11,000	1,760
Cascade Creek I	15,000	5,100	44,781	22,955	4,501	1,530
Cascade Creek II	36,000	17,900	156,672	21,335	1,192	593
Scenery Lake	18,000	9,100	79,716	22,310	2,452	1,239
Total	105,500	51,780	453,583			
Juneau						
Snettisham Expansion I	27,000	11,758	103,000	22,000	1,871	815
Snettisham Expansion II	-	18,607	162,997	16,000	860	-
Total	27,000	30,365	265,997	38,000	1,251	

Attachment C



ENSTAR Natural Gas Company
3000 Spenard Road
P.O. Box 6288
Anchorage, Alaska 99502
(907) 277-5551

February 21, 1983

Senator Vic Fischer
Alaska State Legislature
Pouch V
Juneau, Alaska 99811

Dear Senator Fischer:

Your February 16 letter regarding the February 26 hearings on Susitna and hydro in general arrived today, February 21. I have the annual meeting of my Board of Directors in Houston on February 25 and other appointments already made for February 26. I will therefore not be able to participate in your hearings.

I believe my position on Susitna is well known to the Administration and various agencies, if not to the legislature. I am in favor of Susitna and believe it should receive a combination of state and revenue bond funding. I am not in favor of Bradley Lake hydro.

I may have some time the first week of March, but will not plan to go to Juneau or to testify unless I should be expressly asked to do so. Thank you for contacting me on this matter.

Very truly yours,

ENSTAR Natural Gas Company

Dale Teel
President

DT/dms

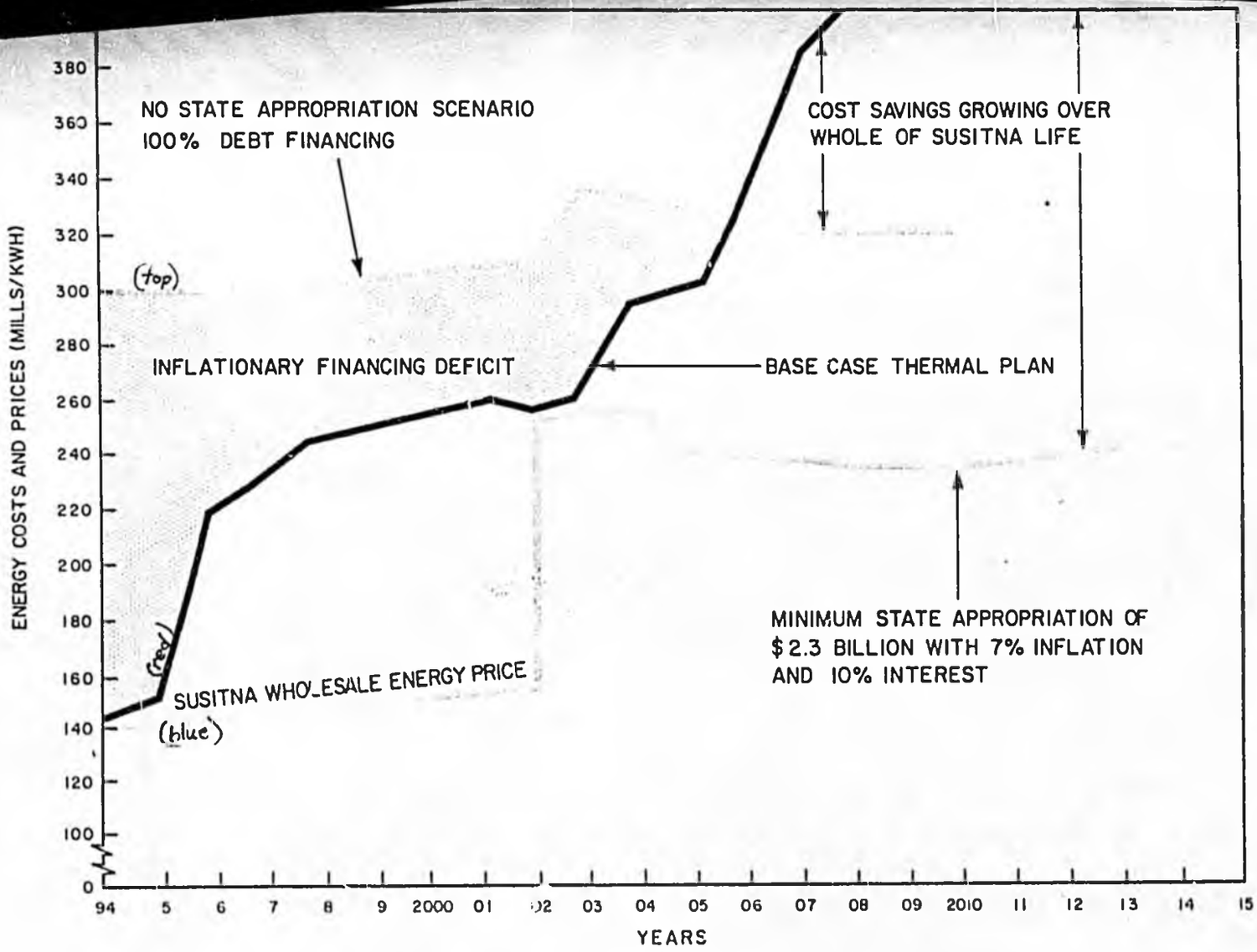
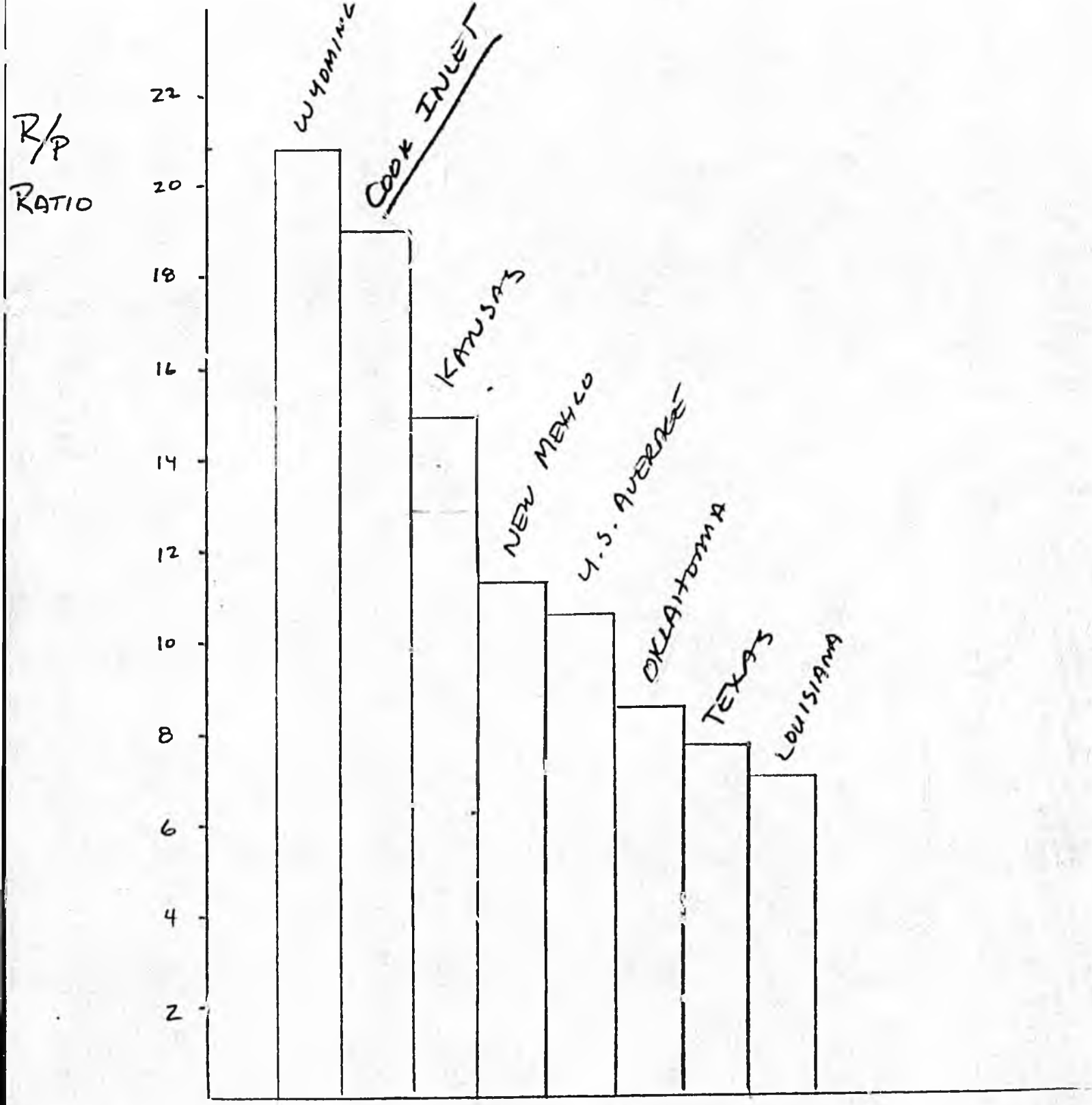


PLATE 26 **ANNUAL COST COMPARISION**

#1

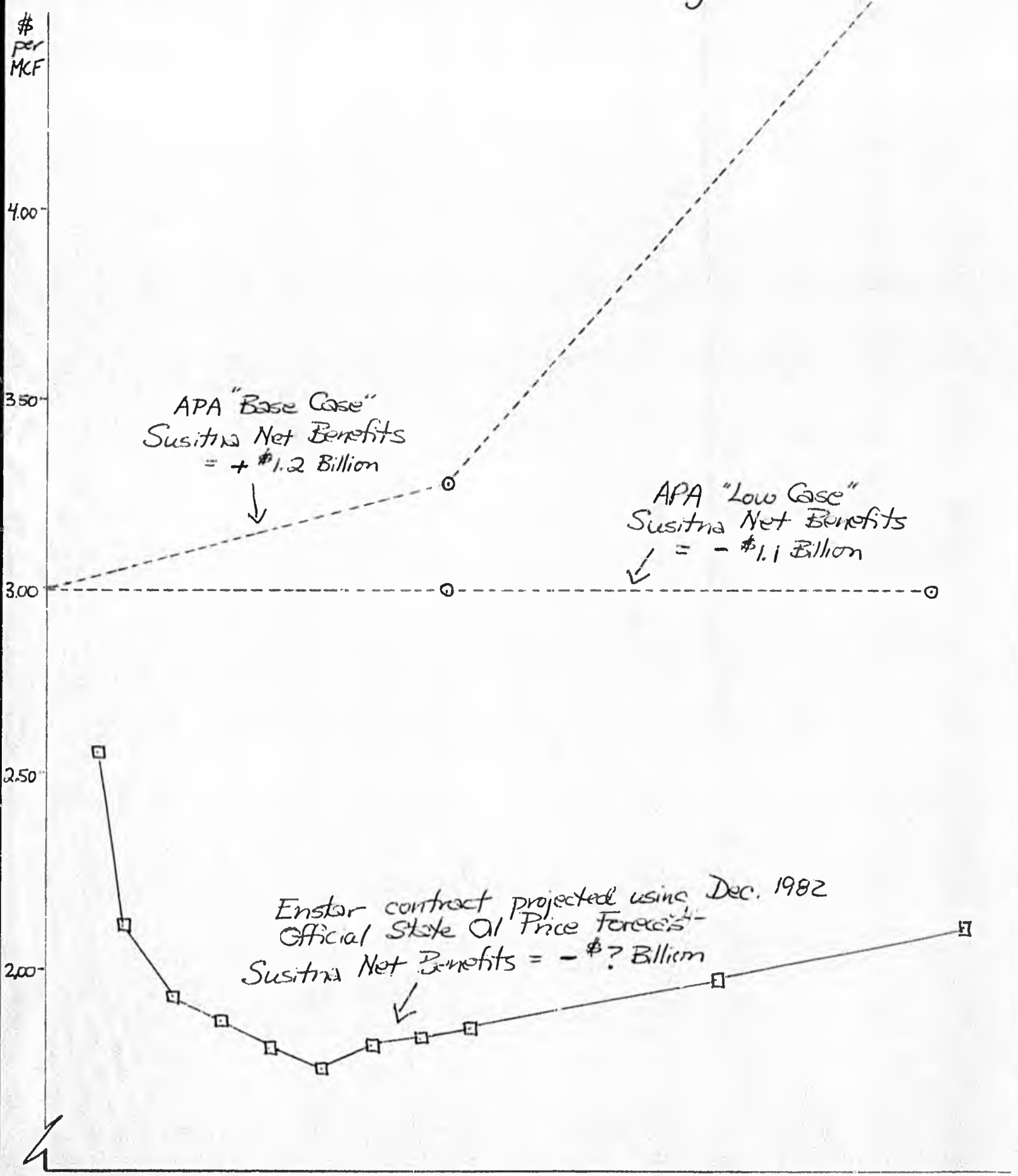
NATURAL GAS RESERVES TO PRODUCTION RATIOS, COOK INLET AND PRINCIPAL PRODUCING REGIONS OF THE U.S.

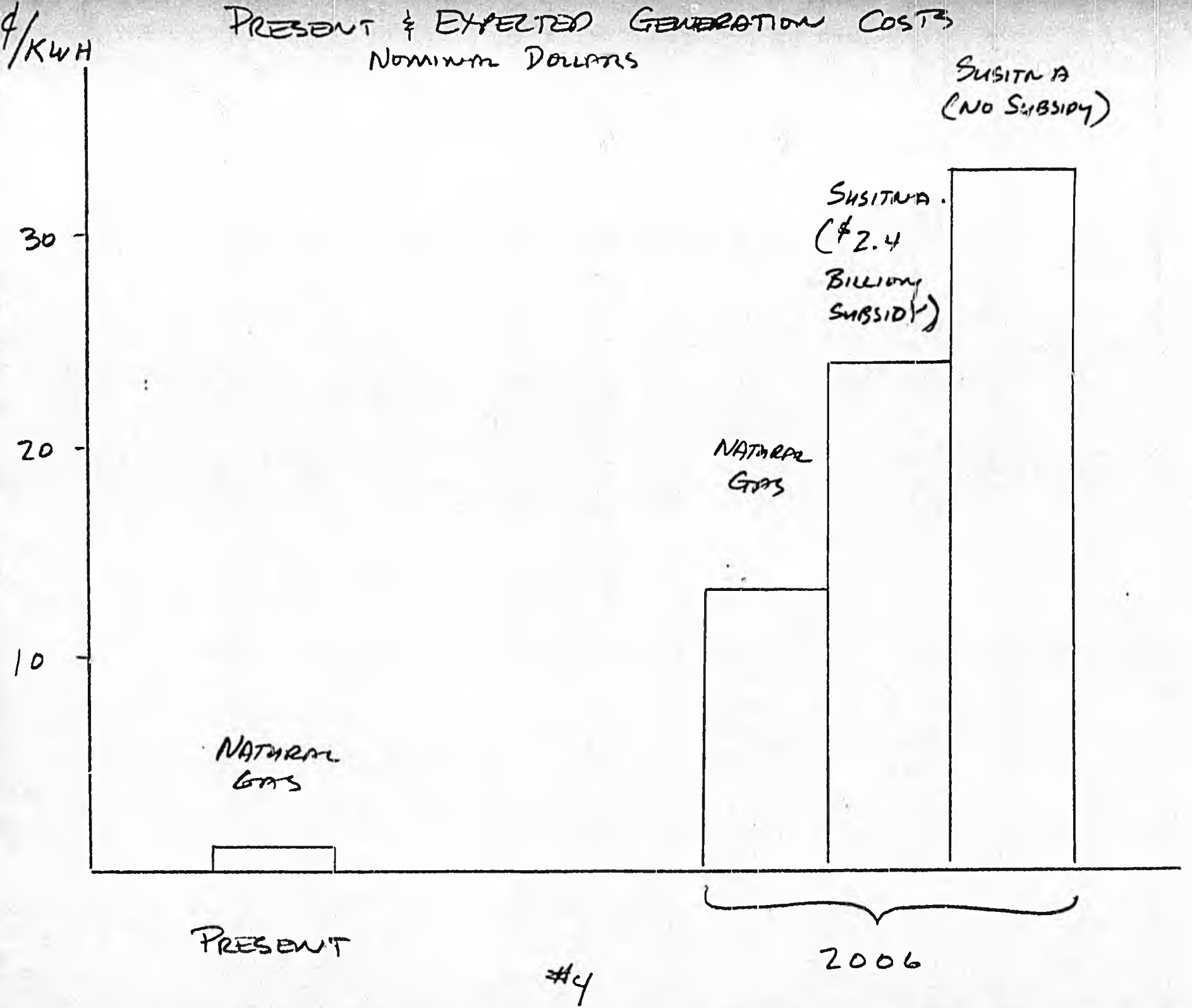


#2

ERICKSON & ASSOC.
3/1/83

Natural Gas Price Projections and Effects on Susitna Feasibility




¢/KWH
PRESENT & EXPECTED GENERATION COSTS
NOMINAL DOLLARS
SUSITNA
(NO SUBSIDY)
SUSITNA
($2.4
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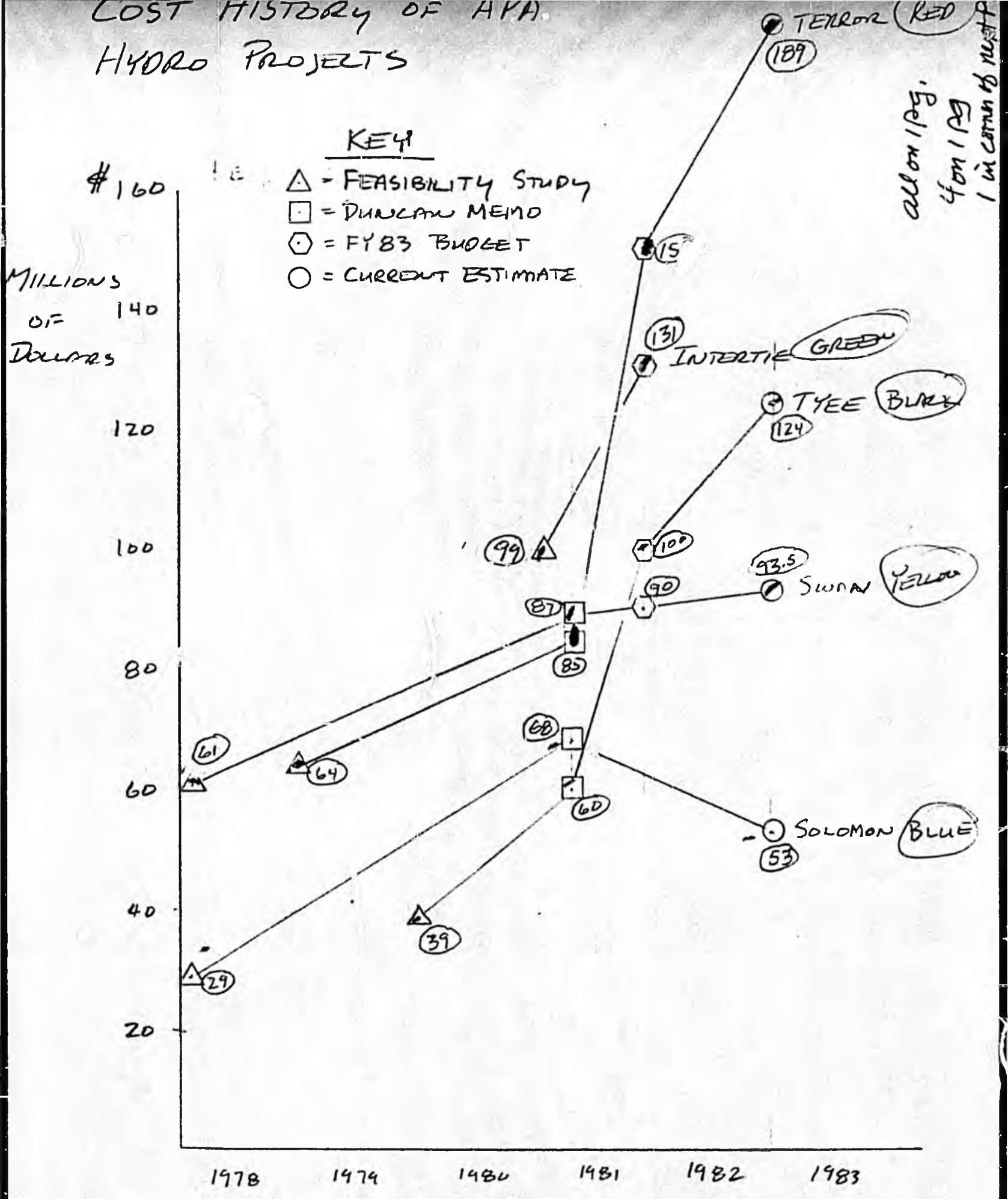
COST HISTORY OF AVA HYDRO PROJECTS



all on 1979.
4 on 1979
1 in common with 1980

#5

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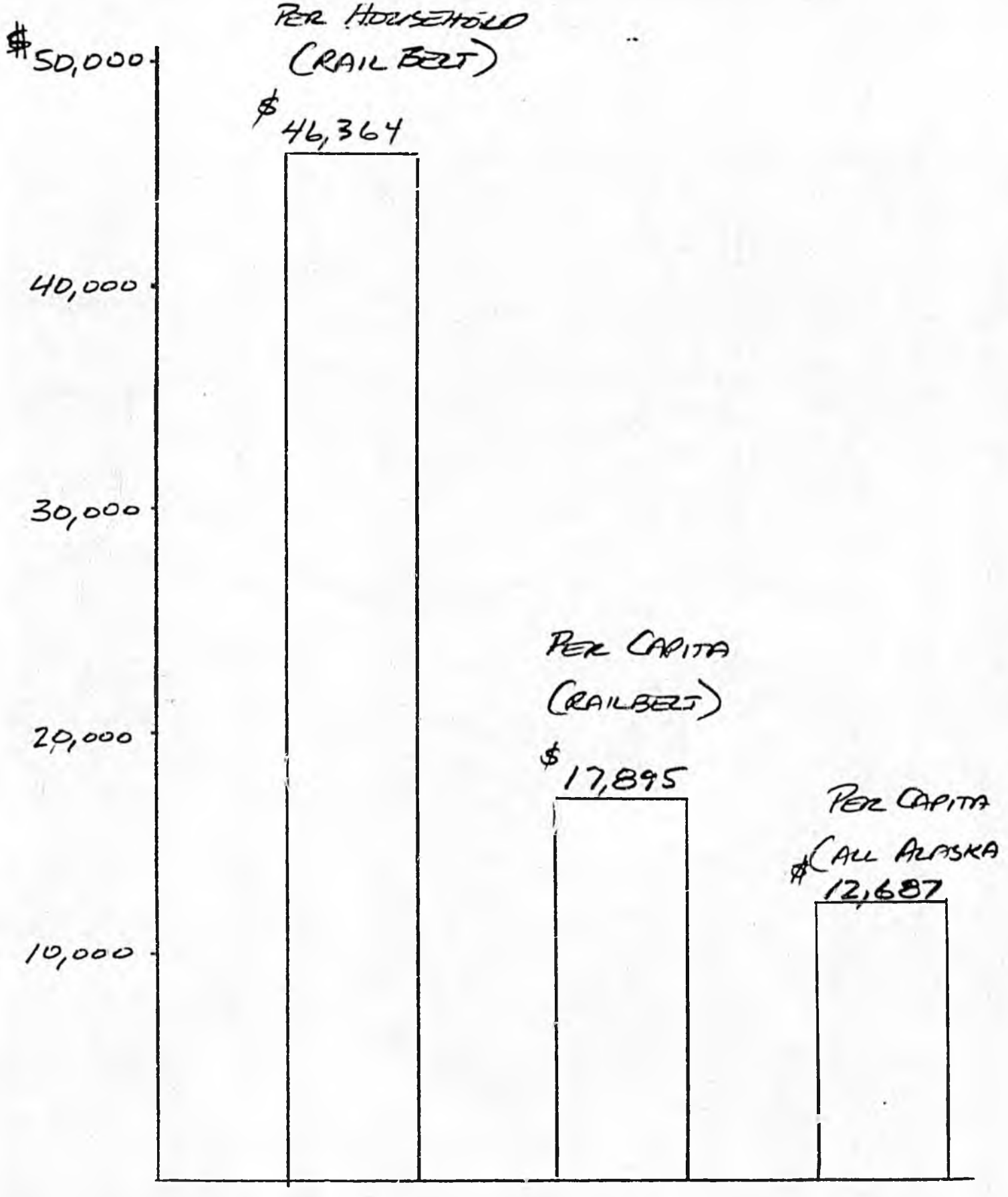
3/1/83

COST OF SUSITNA



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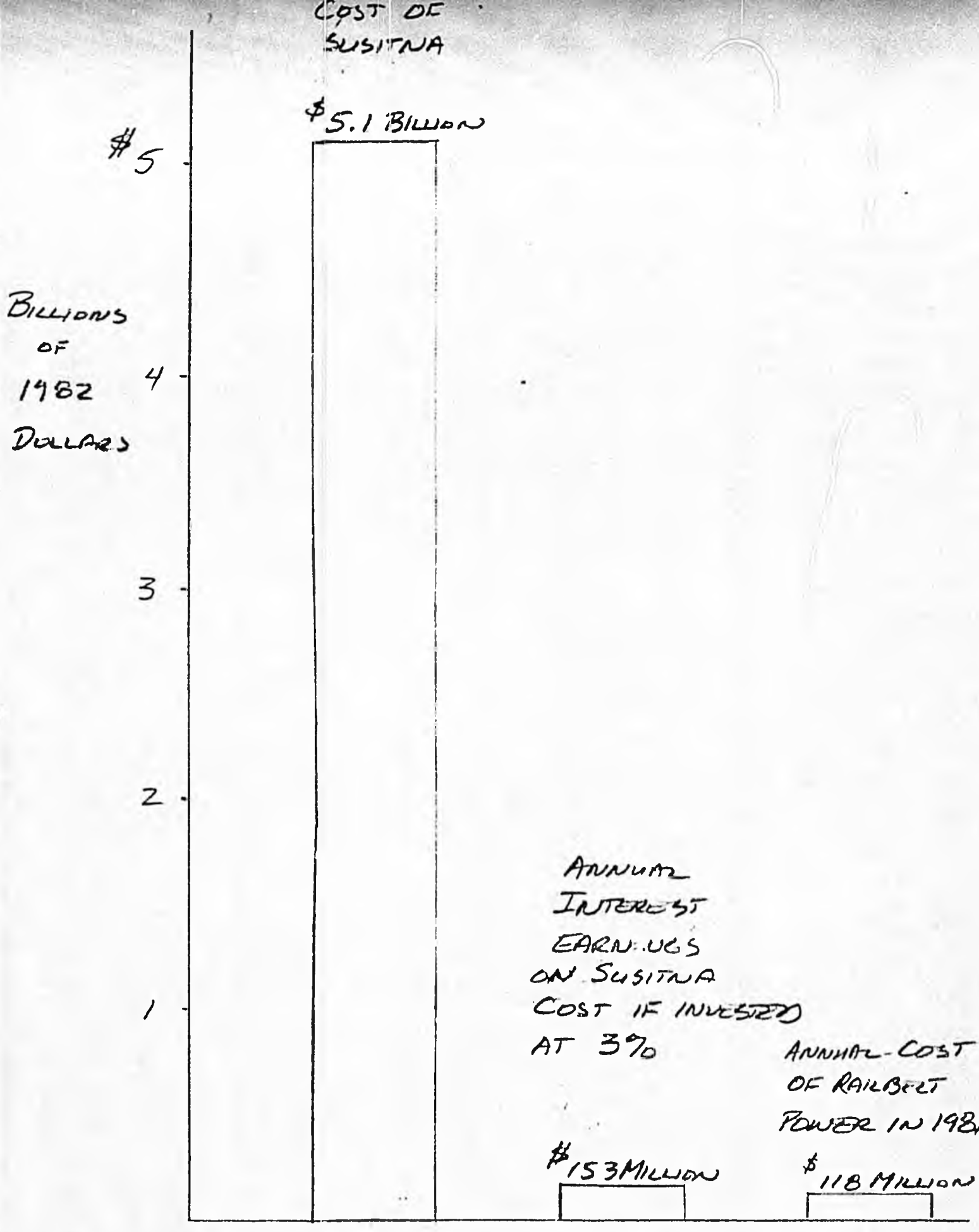

ERICKSON & ASSOCIATES
3/4/83

STATE OF ALASKA

RAILBELT ELECTRICAL POWER ALTERNATIVES STUDY

- REQUEST FOR PROPOSALS -

A. PURPOSE

The State of Alaska is seeking consulting services to prepare an energy plan for the Railbelt which addresses the electric energy needs of the region and evaluates conservation and supply options available to meet projected electricity demand. The plan will review and, where necessary, improve the existing data base and demand forecasts, examine alternative types of electric generation and help determine whether or not the State should concentrate its efforts on development of the hydroelectric potential of the Susitna River and/or pursue other alternatives.

B. BACKGROUND AND STATEMENT OF WORK

The Railbelt includes Anchorage, Fairbanks, Kenai Peninsula and Valdez-Glennallen areas, which together account for about two-thirds of the State's population, or approximately 260,000 people. The region is presently served by nine major utility systems, three of which are municipally owned and operated, one is a federal wholesaler and five are rural electric cooperatives. Another entity, the Alaska Power Authority, is empowered to own, operate, and sell power in the region, but does not do so at the present time.

To date, a number of groups, notably the Corps of Engineers, Alaska Power Administration, the Alaska Power Authority, the Institute of Social and Economic Research and the existing utilities have all engaged in various aspects of Railbelt energy planning. These groups have completed demand-related forecasts and, to a certain extent, have considered a number of supply alternatives for future Railbelt power needs.

To prepare the energy plan, the Consultant will review, revise as necessary and complete demand-related energy forecasts provided by prior studies and rigorously evaluate and compare potential supply alternatives, including relevant emerging technologies. Using the information developed for electric power demand forecasts and supply alternatives, the Consultant will identify the least cost course/courses of action which meet Railbelt power needs and prepare a set of implementation strategies.

Because the demand forecasts, supply analysis and ultimately the energy plan itself, necessarily require assumptions about an uncertain future, the Consultant will design his analysis so as to make all relevant assumptions explicit and to treat all outcomes in a probabilistic manner (where such treatment will enhance understanding). The State has established a four-member Policy Review Committee to assist the Consultant with selection of these assumptions and policies which will influence the outcome of the analysis.

In addition, the Consultant will coordinate his work with the Statewide Energy Development Plan, a plan now underway in the Division of Energy and Power Development. The Contractor will make available the data bases, forecasting techniques, optimization techniques, and alternative supply information to the Division in an easily usable form. The Contractor will also coordinate his work with the Susitna Feasibility Study, an in-progress study contracted to Acres American, Inc. by the Alaska Power Authority, which is determining the optimal design configuration for the Susitna River hydroelectric project.

C. SCOPE OF SERVICES

The principle goal of this effort is to provide the Railbelt with a supply of energy which is adequate to meet future demand and is least costly, consistent with engineering, environmental, and social concerns. This goal will be reached through development of an energy plan and one or more implementation strategies which incorporate any significant uncertainties of both future electric power demand and supply options, and at the same time chart reasonable courses of action to provide economic and reliable energy supplies to residential, commercial and industrial users in the Railbelt area. In the proposal, the Consultant is expected to outline in detail how he will analyze Railbelt energy supply options and prepare an energy plan and implementation strategy. The proposer has significant latitude in defining scope and methodology; however, general guidance is given below.

Task 1: Baseline Analysis

In this task, the Consultant will evaluate, and where appropriate, improve the data base necessary to assess Railbelt energy needs. As a point of departure, the Consultant will review the forecast of total energy requirements prepared by the Institute of Social and Economic Research, the four critiques of the forecast and the soon-to-be completed forecast of peak load requirements prepared by Acres American, Inc. The models used for these forecasts may need further refinement. It will be the responsibility of the Consultant to modify the models as necessary, computerize them, identify gaps in available data, design a data collection program and implement a system to update forecasts. The system must be well designed and documented for future use by the Division of Energy and Power Development.

Task 2: Analysis of Power Alternatives

The analysis of power alternatives involves two subtasks. First the Consultant will review energy supply and conservation options which are relevant for Alaska. Alternatives should include state-of-the-art as well as emerging technologies. Information with respect to hydroelectric developmen

alternatives for the Upper Susitna River Basin need not be considered by the Consultant but instead will be provided by the Alaska Power Authority not later than March 31, 1981. The Consultant will then develop, in concert with the Policy Review Committee and the public, a set of criteria to group the alternatives, weed out improbable choices, and select the most viable energy options for in-depth analysis.

In the second subtask, the Consultant will thoroughly evaluate each viable energy alternative, including the Alaska Power Authority's recommended Susitna Basin development scenario, in terms of physical plant and fuel requirements, expected costs (capital costs, costs to consumer, etc.); major risks; timing considerations; financing; health, safety and environmental effects; socioeconomic impacts; and legal, regulatory or other institutional problems. As in other portions of the analysis, the Consultant will identify major uncertainties and the likelihood of particular outcomes, making sure that all assumptions are explicitly stated.

Task 3: Integration and Optimization

The consultant will evaluate existing generation facilities and projected demand and, incorporating the findings of Task 2, determine what mix of facilities and conservation options would provide the lowest cost electricity for base, intermediate and peak loads. As the existing utilities presently operate independently, the Contractor must consider optimization under both existing conditions and for an integrated Railbelt-wide utility system. The Contractor will identify the steps needed to achieve an integrated system, and compare the economics of optimization under existing conditions and for an integrated system.

Since there are varibles other than cost which may influence the choice of supply mix, the Consultant will work closely with the Policy Review Committee to identify these varibles and incorporate them into the analysis. The Consultant will compare supply options with and without the proposed Susitna hydroelectric project to determine its effect on the cost of electricity, system reliability, etc. The Consultant will determine the relative sensitivity of the various cost elements and supply mixes on the final cost of electricity to the consumer. Finally, for each supply scheme, the Consultant will also examine the short and long-term consequences of overbuilding or underbuilding system capacity.

Since the State of Alaska will make a decision by April 1982 whether to file a license application for the Susitna Hydroelectric Project with the Federal Energy Regulatory Commission (FERC), the Consultant should schedule completion of the Railbelt Power Alternatives Study well in advance of this date to permit an informed decision. Study results may be used in Exhibit W of the FERC license application and thus all method-

report format should be coordinated with Acres American to expedite incorporation of this study report into the license application, in the event it is filed.

D. BUDGET

Approximately $1 million is available to complete the above scope of work. The selected contractor will enter into a fixed price contract with the Office of the Governor, Division of Policy Development and Planning.

E. BACKGROUND INFORMATION AND BRIEFING MEETING

The State of Alaska realizes that prospective contractors will need additional background information to adequately prepare a detailed proposal, cost estimate and schedule, Interested bidders should immediately contact by phone, Mr. Tom Singer, Division of Policy Development and Planning, (907) 465-3573 to obtain a package of relevant background material.

In addition, a briefing meeting is scheduled for August 4, 1980 in Anchorage at 2:00 pm, in the Federal Building. Representatives from the State of Alaska and individuals familiar with Railbelt power planning will make short presentations and be available to answer questions concerning proposal preparation.

F. PROPOSAL FORMAT AND CONTENTS

The proposal will be the primary basis for consultant selection and thus proposals must contain accurate and complete information on methodology, work tasks, cost, schedule, team and past experience. The State of Alaska reserves the right, however, to modify the proposal of the selected Consultant during contact negotiations.

The proposal should contain the following elements:

1. Cover letter

2. Table of Contents

3. Project Concept - Describe your understanding of the problem and the State's needs.

4. Capabilities - Identify the firm(s) that comprise your project team and discuss the capabilities of your firm(s) to successfully perform this work. Describe the ammount of work experience your firm and any and all subcontractors have working as a team.

5. Experience - Provide the following information about three projects accomplished by your firm(s) during the last four

years that most resemble this project in scope.

a) Project Name:
b) Date of Initiation:
c) Date of Completion:
d) Location of Project:
e) Contract Cost:
f) Client:
Individual to contact for reference:
Phone Number:
(Insure that this information is current)
g) Description of Project Scope:
h) Key Members of the Project Team:

6. Geographical Experience - Describe experiences in Alaska or other arctic regions relevant to this study.

7. Project Manager - The Consultant's Project Manager is defined to be the individual within the Consultant's firm who is directly responsible and engaged in performing the required services. The Project Manager is the most knowledgeable individual regarding all aspects of the project, i.e., not necessarily a principal of the firm. Discuss your intended Project Manager's experience and relate that experience to this project.

8. Project Team - List the members of your proposed project team by discipline. Provide resumes, discuss your project team's experience, and relate that experience to this project.

9. Statement of Work - Describe the manner in which you would accomplish this work, to including discussion of:

a) Objective
b) Approach and Methodology
c) Individual Work Tasks
d) Anticipated Results

10. Project Cost - Indicate total estimated budget as well as anticipated expenditures for each major task. Provide a breakdown of hours by task, individual billing rates, labor overhead, general and administrative expense and fee. Describe subcontractor plan.

11. Preliminary Schedule - Provide a proposed schedule showing the timing of the identified tasks, including:

a) Anticipated Milestones
b) Progress reports and review
c) Preliminary reports
d) Final Reports

Indicate how this schedule will coordinate with Acres American, Inc. Susitna Feasibility Study.

12. Policy Review Committee's Role - Discuss proposed procedures for interacting with the Governor's Policy Review Committee and the public.

13. Future Application - Describe how the data base, methodology and models used for this analysis will be documented and transfered for use by the State Division of Energy and Power Development. Discuss limitations and possible problems with transfer of data base and models.

14. Conflict of Interest - State whether you are willing to negotiate an agreement whereby you would accept no other work during the course of this contract (and/or disclose all current contracts) relating to the development of electric power in the Railbelt without prior approval of the State.

15. Professional Engineer Registration - For engineering firms, in accordance with AS 08.48.281, no person may practice or offer to practice the profession of engineering in the State of Alaska unless he has been duly registered, or, in the case of a corporation, unless it has been duly authorized. State whether or not you are duly registered or authorized to perform this work.

16. Supplemental Information, Brochures, etc.

G. CONSULTANT SELECTION

The State of Alaska urges that the preceding format be utilized in project proposals. If changes in the format will significantly improve the quality or clarity of the proposal, include the rationale for changes.

Bidders must demonstrate capability in economic and financial analysis, design and construction experience in a broad range of power supply generation facilities, previous experience with the development and implementation of conservation and load management programs and sucessful studies of this type.

Proposal selection will be made by the four person Policy Review Committee, consisting of the Director of the Division of Energy and Power Development, the Director of the Division of Policy Development and Planning, the Director of the Division of Budget and Management, and the Chairman of the Alaska Power Authority Board of Directors.

The selection committee reserves the right to accept or reject any or all proposals in whole or part. The committee may require proposals to be clarified or supplemented through additional written submissions. Several selected proposers will be requested to present orally their proposal with approximately one week prior notice. All proposers will be notified in writing of the acceptance or rejection of their proposal.

This RFP does not obligate the State of Alaska to pay any cost incurred in the preparation or submission of proposals, nor to enter into a contract of arrangement with any proposer.

H. SUBMISSION OF PROPOSALS

Proposals are due not later than the close of business, August 29, 1980. Bidders should deliver, by mail or in person, a total of six copies of each proposal to the following addresses:

Ms. Frances Ulmer (3 copies)
Director
Division of Policy Development and Planning
Pouch AD
Juneau, Alaska 99811

Ms. Clarissa Quinlan (1 copy)
Director
Division of Energy and Power Development
7th Floor, MacKay Building
338 Denali Street
Anchorage, Alaska 99501

Mr. Eric Yould (2 copies)
Executive Director
Alaska Power Authority
333 West 4th Avenue, Suite 31
Anchorage, Alaska 99501

Questions concerning proposal preparation or format may be addressed to:

Mr. Tom Singer
Policy & Program Specialist
Division of Policy Development and Planning
Pouch AD
Juneau, Alaska 99811
(907) 465-3573

STATE
of ALASKA

MEMORANDUM

TO: Ronald D. Lehr, Director
Division of Budget and Management
Office of the Governor

DATE: April 14, 1982

FILE NO:

TELEPHONE NO:

FROM: George Matz, GM Program Analyst
Division of Budget and Management
Office of the Governor

SUBJECT: Susitna Feasibility Studies

This memo provides a partial review of the Susitna Hydroelectric Project Feasibility Report prepared by Acres and the draft Railbelt Electric Power Alternatives Study prepared by Battelle. The review concentrates on those factors which influence the economic feasibility of the Susitna Project and the alternatives. It is presumed that the External Review Panel and the agencies participating in the Susitna Hydroelectric Steering Committee will provide adequate review of those factors which could influence the engineering and environmental integrity of the Susitna Project.

The intent of this review is to determine the compatability and completeness of the two studies. Consequently, this memo includes two parts which are: 1) reconciliation and 2) open questions. It should be noted that some of the statements in this memo may be subject to change due to revisions by Battelle when completing the final version of their study and possible revisions by Acres.

RECONCILIATION

Acres and Battelle had been given instructions to coordinate their efforts in order to achieve compatible results. Although most of the data is compatible, there are some key differences which prevents a direct comparison between the economic merits of the Susitna Project and likely alternatives. The most significant difference is in the economic analysis methology used by the two firms. Acres determines economic feasibility via a present worth (cost) analysis and Battelle determines the levelized cost of power for each power development plan. Neither study includes enough detailed cost information to reconstruct the data so that accurate comparisons can be made.

The example below illustrates the uncertainty that exists when rough calculations are made which attempt to compare the results of each study. The cost of power is calculated in mills/kwh and discounted to 1981. Acres plan of finance determines the wholesale cost of power and Battelle determines the retail cost of power. Susitna and Plan 1B are similiar as is Thermal and Plan 3 (coal scenario).

	* Acres Cost of Power			** Battelle Cost of Power	
	1995	2005		1995	2005
Susitna	77	32	Plan 1B	67	74
Thermal	41	29	Plan 3	64	79

Following are several tables which illustrate other areas where the two studies are or are not compatible.

I. Fuel Prices

A. January 1982 Fuel Prices ($/10^6 BTU)

Fuel	Acres	Battelle
Fuel Oil	$6.50	$6.93
Cook Inlet Gas	3.00	.86
North Slope Gas	NA	5.92
Beluga Coal	1.43	1.69
Nenana Coal	1.75	1.75

* From Summary Report, plate 26

** From draft Executive Summary, figure 7.2

B. Real Escalation Rates (%)

Fuel	Acres 1982-2000	Acres 2000-2040	Battelle 1980-2010
Fuel Oil	2.0	2.0	2.0
Cook Inlet Gas	2.5	2.0	6.6
North Slope Gas	NA	NA	.0
Beluga Coal	2.6	1.2	2.1
Nenana Coal	2.3	1.1	2.0

Acres assumes that the price for Cook Inlet gas will be determined by the opportunity value which is based on export to Japan. Battelle assumes the existing contract prices for Cook Inlet gas until the contracts expire in 1995 and then a step increase followed by a 2% real escalation. In the year 2010, Acres estimated price would be $5.70 and Battelle's estimated price would be $5.85. Although these are reasonably close, Acres net costs for Cook Inlet gas from 1980-2010 should be higher than Battelle due to higher prices in earlier years.

Acres Summary Report states (page 9) that the "use of North Slope gas for electric energy generation is not considered a viable alternative" due to the uncertainty of ANGTS and prices that are higher than Cook Inlet gas.

II Demand Forecasts

A = Acres net generation forecasts which are based on Battelle's preliminary energy sales forecasts with "an addition of an 8 percent for transmission losses".

B = Battelles' annual energy consumption (sales) forecasts.

A. Energy Demand Forecasts (GWh)

Year	Low			Medium			High		
	A	B	A/B	A	B	A/B	A	B	A/B
1980 Actual	-	2441	-	-	2441	-	-	2441	-
1980 Projected	-	2554	-	-	2551	-	-	2550	-
1985	3234	3028	+ 7%	3431	3136	+ 9%	4231	3238	+31%
1990	3999	3853	+ 4%	4456	4256	+ 5%	5703	5414	+ 5%
1995	4240	4063	+ 4%	4922	4875	+ 1%	6464	6058	+ 7%
2000	4641	3988	+16%	5469	5033	+ 9%	7457	6375	+17%
2005	5358	4278	+25%	6428	5421	+19%	9148	7434	+23%
2010	6303	4936	+28%	7791	6258	+24%	11,435	9011	+27%

B. Average Annual Energy Demand Growth Rates (%)

Years	Low		Medium		High	
	A	B	A	B	A	B
1980-1990	3.8	4.2	4.9	5.3	7.2	7.8
1990-2000	1.5	0.3	2.1	1.7	2.7	7.8
2000-2010	3.1	2.2	3.6	2.2	4.4	3.5
1980-2010	2.8	2.2	3.5	3.0	4.6	4.3

C. Peak Demand Forecasts (MW)

Year	Low			Medium			High		
	A	B	A/B	A	B	A/B	A	B	A/B
1980 Projected	-	522	-	-	521	-	-	521	-
1985	642	621	+ 3%	687	643	+ 7%	794	663	+20%
1990	802	797	+ 1%	892	880	+ 1%	1098	1057	+ 4%
1995	849	837	+ 1%	983	993	- 1%	1248	1175	+ 6%
2000	921	815	+13%	1084	1017	+ 7%	1439	1232	+17%
2005	1066	870	+23%	1270	1092	+16%	1769	1443	+23%
2010	1245	1001	+24%	1537	1259	+22%	2165	1760	+23%

D. Average Annual Peak Demand Growth Rate (%)

Years	Low		Medium		High	
	A	B	A	B	A	B
1980-1990	3.9	2.5	5.0	3.4	7.0	5.1
1990-2000	1.4	1.0	2.0	2.0	2.7	3.2
2000-2010	3.1	1.0	3.6	1.1	4.2	3.2
1980-2010	2.7	1.0	3.5	2.1	4.5	3.8

The Battelle electrical demand forecasting model used December 1981 State revenue projections and assumes that State expenditures strongly influence Railbelt electrical demand. Since then, the States revenue projections have been substantially reduced. Revised forecasts are likely to result in lower demand estimates.

III Capacity Additions and Retirements

A. Expected Capacity Additions 1982-1990

Project	Size (MW)	Acres	Battelle
Beluga Gas Turbine	178	1982	1982
Bernice Lake Gas Turbine	26	1982	-
AML&P Gas Turbine	90	1982	-
Bradley Lake Hydro	90	1988	1988
Grant Lake Hydro	7	1988	-
Anchorage Gas Turbine	70	-	* 1990

B.

1. The Acres Summary Report states (page 5) that "between 1993 and 2010, about 1400 MW of capacity must be added to the system to meet additional demand as well as to replace aging units".

2. From 1993-2010, Battelles Plan 1B (Base Case with Susitna) includes:

555	MW	Retired
367	MW	Increase in Peak Demand
110	MW	Increase in Reserve Margin (30%)
1,032	MW	Additional Capacity

3. Most of the difference between Acres' and Battelles expected capacity increases from 1993-2010 can be accounted for by the difference in the peak demand forecasts.

IV Economic Analysis

A. Assumptions

Criteria	Acres	Battelle
Base Year	January 1982	January 1982
Time Horizon	1993-2010 1993-2051	1981-2010 1981-2050
Real Discount Rate	3.0%	3.0%
Inflation Rate	7.0%	0%
Nominal Discount Rate	10.2%	NA
Interest Rate during Construction	0%	0%
Capital Cost Escalation Rate	1.8%	1.4%
O & M Cost Escalation Rate	0%	2.0%
Fuel Escalation Rate	See previous discussion	See previous discussion

* Plan 1B (Base Case with Susitna) only

Economic Life		
- Hydroelectric Project	50 years	50 years
- Coal-fired Steam Plant	30 years	35 years
- Gas-fired Conbustion Turbine	30 years	20 years
- Gas-fired Combined Cycle	NA	25 years
Reserve Margin	Loss-of-load probability of one day in ten years	30% for all plans
Transmission Losses and Plant use	8%	8%
Availability Date of other Alternatives		
- Bradley Lake	1988	1988
- Solomon Gulch	1982	1982
- Cook Inlet Gas	Up to early 1990's	beyond 1995
- North Slope Gas	NA	NA
- Intertie	1984	1984
- Beluga Coal	1993	1988

B. Information Provided

Type	Acres	Battelle
Annual Demand Per Project	Demand for Susitna and all thermal projects.	No information on a project basis.
Annual Cost Breakdown	For Susitna but not for thermal alternatives. Not included in the breakdown are costs common to each scenario such as investment costs for generation plants in service prior to 1993, costs of transmission and distribution facilities already in service (i.e., Anchorage - Fairbanks intertie) and utility administrative costs.	Cost breakdown for each type of project but not for each plan.
Annual Present Cost	Not provided.	Not Provided
Total Present Cost	For Susitna and thermal alternatives.	Not provided

Cost of Power	Annual cost of wholesale power in nominal terms for Susitna (based on a variety of financing options), and thermal alternatives (based on expected costs).	Levelized cost of retail power in constant dollars for two periods; 1991-2010 and 1981-2050. Also, annualized cost of power from 1980-2010. No information on difference between retail and wholesale price.

V Sensitivity Analysis

Acres and Battelle determined the sensitivity of several key factors. Factors which were common to both studies include fuel escalation rates, load forecasts and capital costs. However, each study used a different approach for measuring sensitivity.

The information below attempts to provide a comparison of the sensitivity results of each study. To measure the relative change of a plan to different conditions, the "most likely" condition is given a value of 100. It should not be implied that a value of 100 for one plan is comparable, in terms of economic feasibility, to a value of 100 for other plans. Alternatives having values less than 100 are less costly than the "most likely" condition and, conversely, alternatives having values greater than 100 are more costly than the. Acres calculations are based on 1982 present worth from 1993-2010. Battelle calculations are based on levelized costs from 1981-2010.

A. Fuel Escalation Rates

	0%	1%	2%	3%	5%
Acres					
- Susitna	96		100		105
- Thermal	69		100		126
Battelle					
- Plan 1A		97	100	103	
- Plan 1B		98	100	102	
- Plan 2A		97	100	103	
- Plan 2B		100	100	98	
- Plan 3		98	100	105	
- Plan 4		93	100	103	

The Acres study shows that the present worth of the thermal plan is more sensitive to fuel escalation rates than Susitna. In other words, the economic feasibility of the thermal plan, relative to Susitna, improves with lower fuel escalation rates and vice versa. However, the Battelle study shows variance in fuel escalation rates has little, if any, affect on the economic feasibility of any plan.

B. Load Forecasts

	Low	Medium	High
Acres			
- Susitna	92	100	124
- Thermal	82	100	130
Battelle			
- Plan 1A	100	100	103
- Plan 1B	100	100	100
- Plan 2A	98	100	98
- Plan 2B	98	100	98
- Plan 3	98	100	105
- Plan 4	97	100	103

The Acres study shows that, for the low forecast, the reduction in present worth for the thermal plan is nearly proportional to the load reduction from the medium forecast. For the high forecast, the increase in present worth is about 2/3 of the increase in load. Since the Susitna Project is more capital-intensive, it is less responsive to changes in load forecast. The Battelle plan does not indicate that the cost of power for any plan is sensitive to changes in load forecasts.

C. Variations from Capital Cost Estimates

	-20%	-17%	-10%	0	+17%	+20%
Acres						
- Susitna		87		100	113	
- Thermal			96	100		108
Battelle						
- Susitna						
Plan 1B	93			100		105
Plan 2B	93			100		107
- Coal						
Plan 1A	98			100		102
Plan 3	97			100		102
- Conservation						
Plan 2A	100			100		102
Plan 2B	97			100		102
- Chakachamna						
Plan 1A	98			100		102
Plan 2A	97			100		102

Acres and Battelle assumed different levels of capital cost increases and decreases. Acres shows that the Susitna Project, being more capital-intensive, is more sensitive to cost variations than the thermal plan. The Battelle study shows that the variance in the cost of power will not be proportional to variations in capital cost estimates. This can be partially explained by Battelle calculating retail power costs, rather than wholesale power costs, which includes distribution and administrative costs.

OPEN QUESTIONS

For each study, there are several open questions which could affect the economic feasibility of the Susitna Project and/or alternatives. Acres questions will address only the Susitna Project. Battelle questions will address only the alternatives and load forecasts.

I Acres

A. Interest During Construction - Acres did not include Interest During Construction in their cost analysis. Considering the lengthy construction period, Interest During Construction may be a substantial unaccounted for cost.

B. Watana - Acres was asked, during their presentation in Anchorage, if only the Watana Dam could be economically feasible. The answer was no, but another version of the Devil Canyon Dam could be independently feasible. Information should be developed which address the independent economic feasibility of the Watana Dam and the Devil Canyon Dam.

C. Minimal Flow - In the feasibility study, Acres assumed stream flows which resulted in optimal electrical generation. However, streamflows less than optimal are needed to protect downstream fisheries. During the Anchorage presentation, Acres stated that maintaining present streamflows would result in about half as much energy generation benefits and that information was inadequate at this time to determine the optimal tradeoff between energy generation and protection of the fisheries. Firm information is needed on minimal flow requirements and how seasonal flow variations relate to seasonal energy demand and economic feasibility.

D. Timing - The feasibility study shows that the cost/cost for the Susitna Project is .92 for the 1993-2010 period assuming the low load forecast and the thermal plan as the alternative. This raises a question of timing. Considering fuel prices, load forecasts, etc., when would be the optimal time for the Susitna Project to come on line?

E. Power Sales Contracts - The feasibility study cautioned that utility demand for wholesale power could be affected by the cost of other alternatives, particularly gas-fired turbines. Contract arrangements similar to that of the Swan Lake Project coupled with an abundance of relatively inexpensive natural gas could result in marginal utilization of the Susitna Project. The feasibility states "It is essential, however, that appropriate contracts are established between the APA and the major utilities as a precondition for the actual commencement of Susitna".

F. Access - The feasibility study stated that a pioneer road could provide temporary all-weather access and would have to be started in 1983 to keep the Susitna Project on schedule for 1993 startup. The cost for the pioneer road is not given. Also, if an access road is needed by mid-1986 and it takes 18 months to build a pioneer road it is not apparent that construction of a pioneer road must begin in 1983. It should be noted that a pioneer road would be beyond the scope of "preliminary work" allowed by SB 826.

G. Geotechnical - It appears that more data is needed to resolve some potential geotechnical problems such as the relict channel. This may result in a design changes which are more expensive and/or not capable of generating as much energy.

H. Economic Life - The time horizon for the Susitna Project economic analysis extends from 1993-2051. The Watana Dam is assumed to have a 50 year economic life and to come on-line in 1993. Consequently, its retirement would be in 2043. It does not appear that costs for extending its life to 2051 are included in the present worth calculations. Also, the APA assumes an economic life of 20 years for transmission lines. The replacement costs for the Anchorage - Fairbanks Intertie (which are not included in the cost of the Susitna Project) and additional transmission lines needed for the Susitna Project, do not appear to be included in the present worth calculations.

II Battelle

A. Cook Inlet Gas - Battelle devoted considerable effort to assessing the availability of Cook Inlet gas. However, due to the confidentially of this information, substantial uncertainty remains. Perhaps the State has access to information which could improve the understanding of gas resources.

B. North Slope Gas - The availability of North Slope gas and the possibility of using this gas to generate electricity on the North Slope for transmission to Fairbanks needs to be explored. The Division of Budget and Management is taking a preliminary look at this option.

C. Revenue Projections - The load forecasts need to account for the recent decline in the States revenue projections. Battelle is now reviewing the most recent revenue projections and will estimate what effort is needed for revised load forecasts.

D. Forecasting Model - The MAP, RED and AREEP models need critical review. It does not appear that these models converge with actual data. Also the industrial development assumptions in Table A.1 should be reviewed based on current conditions.

E. Cost Breakdowns - It does not appear that the AREEP model can easily provide the cost data that is described in Figure 6.2 of the Executive Summary. This could be a serious deficiency if the model is applied to additional energy planning efforts. The PRC needs to have a better understanding of the AREEP model features and shortcomings before accepting State ownership.

F. Glennallen - Valdez - The PRC decided to include Glennallen - Valdez in the load forecasts but not to provide the area with Railbelt power. Battelle included the Allison Lake Project, near Valdez, in their project slate and presumably a transmission line to the Anchorage area. Consideration should be given to deleting this project from the power development plans.

G. Cogeneration & Waste Heat - Cogeneration and benefits from waste heat were not considered by Battelle. Consideration should be given to siting thermal plants near a market for waste heat.

H. Interest During Construction - Battelle did not include Interest During Construction in their project cost estimates. The significance of this cost is not as significant with the alternatives as it is with the Susitna Project due to shorter construction periods but nevertheless, needs to be accounted for.

SUSITNA HYDROELECTRIC PROJECT

APR 12 1982

BUDGET AND MANAGEMENT

TO: All Recipients of the Susitna Hydroelectric Project Feasibility Report

Certain statements in the Feasibility Report regarding agency agreement to minimum flows during reservoir filling are either in error or may be open to misinterpretation. They include those found in Vol. 1, Page 2-60; Summary Report, Page 29; Vol. 1, Page 15-8 and Page 15-9; Vol. 1, Table 15-2; and Vol. 2, Page 3-182.

It is clearly understood by Acres that formal agency review and comment regarding fish and wildlife impact assessment and mitigation plans will be sought before such plans are forwarded to FERC as part of Exhibit E. It is further understood that agency comments can be provided only after the statutory period is allowed for review. This period would commence when the relevant documents and supporting data have been provided to the agencies involved.

Contrary to the statements contained in the above referenced places in the draft Susitna Hydroelectric Project Feasibility Report, agency agreement has not been obtained at this time. Thus, nothing in the Feasibility Report with regard to minimum flows during reservoir filling should be construed as signifying prior approval by the agencies.

Sincerely,

James O. Lawrence

for John D. Lawrence
Project Manager

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ALASKA POWER AUTHORITY

MEMO TO: Jim Souby
Director
Division of Policy Development
and Planning

April 26, 1982

Ron Lehr
Director
Division of Budget & Management

Lloyd Pernela
Director
Division of Energy
and Power Development

FROM: Eric P. Yould
Executive Director
Alaska Power Authority

SUBJECT: Susitna Feasibility Studies

I have reviewed the "open questions" regarding the Acres study identified by George Matz in a memo to Ron Lehr dated April 14, 1982, and offer the following:

A. The $5.1 billion cost estimate for the Susitna Project is an "overnight" estimate in January, 1982 dollars and, as such, does not include any interest during construction. The OGP analysis, which generates system-wide production costs over the period of analysis, on the other hand, includes interest during construction in the calculation of an "investment cost" for each project. The interest rate is 3 percent, in keeping with the inflation-adjusted analysis. The amount of interest expense added to the Watana capital cost in the OGP analysis was $447 million and that for Devil Canyon was $163 million. Refer to the last sentence of paragraph 16.5 in the draft Feasibility Report. I believe you will also find that Battelle, as well as Acres, includes interest during construction in their economic analysis.

B. The economic analysis of the Watana and Devil Canyon projects independent of each other is presented below for both the mid-range and low-range load forecasts. The quoted figures represent discounted system production costs over the economic analysis period (to 2051 for the mid-range forecast case and to 2045 for the low forecast case), in billions of dollars.

	Mid	Low
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Be aware that a Devil Canyon project without Watana upstream differs from one with Watana. The necessary adjustments in cost and monthly energy distribution have been included in the results above.

C. The economic analysis is based on a flow regime that maximizes useful energy output. It is generally agreed that downstream flows of no more than 19,000 cfs would be required for approximately six weeks in late summer in order to avoid flow-related impacts on downstream fisheries. This flow regime has been termed the "impact avoidance flow", and it results in more energy being available in the summer when it is not needed and less in the winter when it is. Use of the avoidance flow results in a $600 million reduction in the $1.2 billion net benefits of the base case economic analysis. More work is required to assess fishery impacts of flows between the optimum power flows and the avoidance flows. That work is underway and a key objective of the FY-83 environmental program. The ultimate flow regime will evolve as part of the mitigation plan agreed upon during the FERC licensing process. It presently appears that satisfactory mitigation means will be found that cost much less than the $600 million cost of the avoidance flows, however, that is the subject of intensive study.

D. A series of OGP runs has been made to determine the effect on net benefits of varied project in-service dates. Net benefits turn out to be relatively insensitive to a planned postponement of the project. Of course, there are other important considerations, such as bond interest rates and state financial resources that must also be weighed in determining optimum timing. The results of the analysis by Acres is attached. Net benefits are maximized with a Watana 1993 in-service date (using the base case set of parameters).

E. No comment.

F. The cost of the pioneer road is $39 million and is included in the project cost estimate. (Item #336.1.11 in the detailed estimate). Acres has been directed to reassess their access plan recommendation, and that work is underway to find an access plan that meets the optimum project schedule without the need for a pioneer road, while also being responsive to environmental, land use and public preference objectives. The tradeoffs on this issue are many and complex.

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STATE
of ALASKA

MEMORANDUM

TO: Ronald D. Lehr, Director
Division of Budget and Management
Office of the Governor

DATE: April 14, 1982

FILE NO:

TELEPHONE NO:

FROM: George Matz, GM
Program Analyst
Division of Budget and Management
Office of the Governor

SUBJECT: Susitna Feasibility Studies

This memo provides a partial review of the Susitna Hydroelectric Project Feasibility Report prepared by Acres and the draft Railbelt Electric Power Alternatives Study prepared by Battelle. The review concentrates on those factors which influence the economic feasibility of the Susitna Project and the alternatives. It is presumed that the External Review Panel and the agencies participating in the Susitna Hydroelectric Steering Committee will provide adequate review of those factors which could influence the engineering and environmental integrity of the Susitna Project.

The intent of this review is to determine the compatability and completeness of the two studies. Consequently, this memo includes two parts which are: 1) reconciliation and 2) open questions. It should be noted that some of the statements in this memo may be subject to change due to revisions by Battelle when completing the final version of their study and possible revisions by Acres.

RECONCILIATION

Acres and Battelle had been given instructions to coordinate their efforts in order to achieve compatible results. Although most of the data is compatible, there are some key differences which prevents a direct comparison between the economic merits of the Susitna Project and likely alternatives. The most significant difference is in the economic analysis methology used by the two firms. Acres determines economic feasibility via a present worth (cost) analysis and Battelle determines the levelized cost of power for each power development plan. Neither study includes enough detailed cost information to reconstruct the data so that accurate comparisons can be made.

The example below illustrates the uncertainty that exists when rough calculations are made which attempt to compare the results of each study. The cost of power is calculated in mills/kwh and discounted to 1981. Acres plan of finance determines the wholesale cost of power and Battelle determines the retail cost of power. Susitna and Plan 1B are similiar as is Thermal and Plan 3 (coal scenario).

	* Acres Cost of Power			** Battelle Cost of Power	
	1995	2005		1995	2005
Susitna	77	32	Plan 1B	67	74
Thermal	41	29	Plan 3	64	79

Following are several tables which illustrate other areas where the two studies are or are not compatible.

I. Fuel Prices

A. January 1982 Fuel Prices ($/$10^6$ BTU)

Fuel	Acres	Battelle
Fuel Oil	$6.50	$6.93
Cook Inlet Gas	3.00	.86
North Slope Gas	NA	5.92
Beluga Coal	1.43	1.69
Nenana Coal	1.75	1.75

* From Summary Report, plate 26

** From draft Executive Summary, figure 7.2

3. Real Escalation Rates (%)

Fuel	Acres 1982-2000	Acres 2000-2040	Battelle 1980-2010
Fuel Oil	2.0	2.0	2.0
Cook Inlet Gas	2.5	2.0	6.6
North Slope Gas	NA	NA	.0
Beluga Coal	2.6	1.2	2.1
Nenana Coal	2.3	1.1	2.0

Acres assumes that the price for Cook Inlet gas will be determined by the opportunity value which is based on export to Japan. Battelle assumes the existing contract prices for Cook Inlet gas until the contracts expire in 1995 and then a step increase followed by a 2% real escalation. In the year 2010, Acres estimated price would be $5.70 and Battelle's estimated price would be $5.85. Although these are reasonably close, Acres net costs for Cook Inlet gas from 1980-2010 should be higher than Battelle due to higher prices in earlier years.

Acres Summary Report states (page 9) that the "use of North Slope gas for electric energy generation is not considered a viable alternative" due to the uncertainty of ANGTS and prices that are higher than Cook Inlet gas.

II Demand Forecasts

A = Acres net generation forecasts which are based on Battelle's preliminary energy sales forecasts with "an addition of an 8 percent for transmission losses".

B = Battelles' annual energy consumption (sales) forecasts.

A. Energy Demand Forecasts (GWh)

Year	Low			Medium			High		
	A	B	A/B	A	B	A/B	A	B	A/B
1980 Actual	-	2441	-	-	2441	-	-	2441	-
1980 Projected	-	2554	-	-	2551	-	-	2550	-
1985	3234	3028	+ 7%	3431	3136	+ 9%	4231	3238	+31%
1990	3999	3853	+ 4%	4456	4256	+ 5%	5703	5414	+ 5%
1995	4240	4063	+ 4%	4922	4875	+ 1%	6464	6058	+ 7%
2000	4641	3988	+16%	5469	5033	+ 9%	7457	6375	+17%
2005	5358	4278	+25%	6428	5421	+19%	9148	7434	+23%
2010	6303	4936	+28%	7791	6258	+24%	11,435	9011	+27%

B. Average Annual Energy Demand Growth Rates (%)

Years	Low		Medium		High	
	A	B	A	B	A	B
1980-1990	3.8	4.2	4.9	5.3	7.2	7.8
1990-2000	1.5	0.3	2.1	1.7	2.7	7.8
2000-2010	3.1	2.2	3.6	2.2	4.4	3.5
1980-2010	2.8	2.2	3.5	3.0	4.6	4.3

C. Peak Demand Forecasts (MW)

Year	Low			Medium			High		
	A	B	A/B	A	B	A/B	A	B	A/B
1980 Projected	-	522	-	-	521	-	-	521	-
1985	642	621	+ 3%	687	643	+ 7%	794	663	+20%
1990	802	797	+ 1%	892	880	+ 1%	1098	1057	+ 4%
1995	849	837	+ 1%	983	993	- 1%	1248	1175	+ 6%
2000	921	815	+13%	1084	1017	+ 7%	1439	1232	+17%
2005	1066	870	+23%	1270	1092	+16%	1769	1443	+23%
2010	1245	1001	+24%	1537	1259	+22%	2165	1760	+23%

D. Average Annual Peak Demand Growth Rate (%)

Years	Low		Medium		High	
	A	B	A	B	A	B
1980-1990	3.9	2.5	5.0	3.4	7.0	5.1
1990-2000	1.4	1.0	2.0	2.0	2.7	3.2
2000-2010	3.1	1.0	3.6	1.1	4.2	3.2
1980-2010	2.7	1.0	3.5	2.1	4.5	3.8

The Battelle electrical demand forecasting model used December 1981 State revenue projections and assumes that State expenditures strongly influence Railbelt electrical demand. Since then, the States revenue projections have been substantially reduced. Revised forecasts are likely to result in lower demand estimates.

III Capacity Additions and Retirements

A. Expected Capacity Additions 1982-1990

Project	Size (MW)	Acres	Battelle
Beluga Gas Turbine	178	1982	1982
Bernice Lake Gas Turbine	26	1982	-
AML&P Gas Turbine	90	1982	-
Bradley Lake Hydro	90	1988	1988
Grant Lake Hydro	7	1988	-
Anchorage Gas Turbine	70	-	* 1990

B.

1. The Acres Summary Report states (page 5) that "between 1993 and 2010, about 1400 MW of capacity must be added to the system to meet additional demand as well as to replace aging units".

2. From 1993-2010, Battelles Plan 1B (Base Case with Susitna) includes:

555	MW	Retired
367	MW	Increase in Peak Demand
110	MW	Increase in Reserve Margin (30%)
1,032	MW	Additional Capacity

3. Most of the difference between Acres' and Battelles expected capacity increases from 1993-2010 can be accounted for by the difference in the peak demand forecasts.

IV Economic Analysis

A. Assumptions

Criteria	Acres	Battelle
Base Year	January 1982	January 1982
Time Horizon	1993-2010	1981-2010
	1993-2051	1981-2050
Real Discount Rate	3.0%	3.0%
Inflation Rate	7.0%	0%
Nominal Discount Rate	10.2%	NA
Interest Rate during Construction	0%	0%
Capital Cost Escalation Rate	1.8%	1.4%
O & M Cost Escalation Rate	0%	2.0%
Fuel Escalation Rate	See previous discussion	See previous discussion

* Plan 1B (Base Case with Susitna) only

Economic Life		
- Hydroelectric Project	50 years	50 years
- Coal-fired Steam Plant	30 years	35 years
- Gas-fired Conbustion Turbine	30 years	20 years
- Gas-fired Combined Cycle	NA	25 years
Reserve Margin	Loss-of-load probability of one day in ten years	30% for all plans
Transmission Losses and Plant use	8%	8%
Availability Date of other Alternatives		
- Bradley Lake	1988	1988
- Solomon Gulch	1982	1982
- Cook Inlet Gas	Up to early 1990's	beyond 1995
- North Slope Gas	NA	NA
- Intertie	1984	1984
- Beluga Coal	1993	1988

B. Information Provided

Type	Acres	Battelle
Annual Demand Per Project	Demand for Susitna and all thermal projects.	No information on a project basis.
Annual Cost Breakdown	For Susitna but not for thermal alternatives. Not included in the breakdown are costs common to each scenario such as investment costs for generation plants in service prior to 1993, costs of transmission and distribution facilities already in service (i.e., Anchorage - Fairbanks intertie) and utility administrative costs.	Cost breakdown for each type of project but not for each plan.
Annual Present Cost	Not provided.	Not Provided
Total Present Cost	For Susitna and thermal alternatives.	Not provided

Cost of Power	Annual cost of wholesale power in nominal terms for Susitna (based on a variety of financing options), and thermal alternatives (based on expected costs).	Levelized cost of retail power in constant dollars for two periods; 1991-2010 and 1981-2050. Also, annualized cost of power from 1980-2010. No information on difference between retail and wholesale price.

V Sensitivity Analysis

Acres and Battelle determined the sensitivity of several key factors. Factors which were common to both studies include fuel escalation rates, load forecasts and capital costs. However, each study used a different approach for measuring sensitivity.

The information below attempts to provide a comparison of the sensitivity results of each study. To measure the relative change of a plan to different conditions, the "most likely" condition is given a value of 100. It should not be implied that a value of 100 for one plan is comparable, in terms of economic feasibility, to a value of 100 for other plans. Alternatives having values less than 100 are less costly than the "most likely" condition and, conversely, alternatives having values greater than 100 are more costly than the. Acres calculations are based on 1982 present worth from 1993-2010. Battelle calculations are based on levelized costs from 1981-2010.

A. Fuel Escalation Rates

	0%	1%	2%	3%	5%
Acres					
- Susitna	96		100		103
- Thermal	69		100		126
Battelle					
- Plan 1A		97	100	103	
- Plan 1B		98	100	102	
- Plan 2A		97	100	103	
- Plan 2B		100	100	98	
- Plan 3		98	100	105	
- Plan 4		93	100	103	

The Acres study shows that the present worth of the thermal plan is more sensitive to fuel escalation rate than Susitna. In other words, the economic feasibility of the thermal plan, relative to Susitna, improves with lower fuel escalation rates and vice versa. However, the Battelle study shows variance in fuel escalation rates has little, if any, affect on the economic feasibility of any plan.

B. Load Forecasts

	Low	Medium	High
Acres			
- Susitna	92	100	124
- Thermal	82	100	130
Battelle			
- Plan 1A	100	100	103
- Plan 1B	100	100	100
- Plan 2A	98	100	98
- Plan 2B	98	100	98
- Plan 3	98	100	105
- Plan 4	97	100	103

The Acres study shows that, for the low forecast, the reduction in present worth for the thermal plan is nearly proportional to the load reduction from the medium forecast. For the high forecast, the increase in present worth is about 2/3 of the increase in load. Since the Susitna Project is more capital-intensive, it is less responsive to changes in load forecast. The Battelle plan does not indicate that the cost of power for any plan is sensitive to changes in load forecasts.

C. Variations from Capital Cost Estimates

	-20%	-17%	-10%	0	+17%	+20%
Acres						
- Susitna		87		100	113	
- Thermal			96	100		108
Battelle						
- Susitna						
Plan 1B	93			100		105
Plan 2B	93			100		107
- Coal						
Plan 1A	98			100		102
Plan 3	97			100		102
- Conservation						
Plan 2A	100			100		102
Plan 2B	97			100		102
- Chakachamna						
Plan 1A	98			100		102
Plan 2A	97			100		102

Acres and Battelle assumed different levels of capital cost increases and decreases. Acres shows that the Susitna Project, being more capital-intensive, is more sensitive to cost variations than the thermal plan. The Battelle study shows that the variance in the cost of power will not be proportional to variations in capital cost estimates. This can be partially explained by Battelle calculating retail power costs, rather than wholesale power costs, which includes distribution and administrative costs.

OPEN QUESTIONS

For each study, there are several open questions which could affect the economic feasibility of the Susitna Project and/or alternatives. Acres questions will address only the Susitna Project. Battelle questions will address only the alternatives and load forecasts.

I Acres

A. Interest During Construction - Acres did not include Interest During Construction in their cost analysis. Considering the lengthy construction period, Interest During Construction may be a substantial unaccounted for cost.

B. Watana - Acres was asked, during their presentation in Anchorage, if only the Watana Dam could be economically feasible. The answer was no, but another version of the Devil Canyon Dam could be independently feasible. Information should be developed which address the independent economic feasibility of the Watana Dam and the Devil Canyon Dam.

C. Minimal Flow - In the feasibility study, Acres assumed stream flows which resulted in optimal electrical generation. However, streamflows less than optimal are needed to protect downstream fisheries. During the Anchorage presentation, Acres stated that maintaining present streamflows would result in about half as much energy generation and that information was inadequate at this time to determine the optimal tradeoff between energy generation and protection of the fisheries. Firm information is needed on minimal flow requirements and how seasonal flow variations relate to seasonal energy demand and economic feasibility.

D. Timing - The feasibility study shows that the cost/cost for the Susitna Project is .92 for the 1993-2010 period assuming the low load forecast and the thermal plan as the alternative. This raises a question of timing. Considering fuel prices, load forecasts, etc., when would be the optimal time for the Susitna Project to come on line?

E. Power Sales Contracts - The feasibility study cautioned that utility demand for wholesale power could be affected by the cost of other alternatives, particularly gas-fired turbines. Contract arrangements similar to that of the Swan Lake Project coupled with an abundance of relatively inexpensive natural gas could result in marginal utilization of the Susitna Project. The feasibility states "It is essential, however, that appropriate contracts are established between the APA and the major utilities as a precondition for the actual commencement of Susitna".

. feasibility study stated that a pioneer road could
porary all-weather access and would have to be started in
p the Susitna Project on schedule for 1993 startup. The
he pioneer road is not given. Also, if an access road is
mid-1986 and it takes 18 months to build a pioneer road it
pparent that construction of a pioneer road must begin in
It should be noted that a pioneer road would be beyond the
of "preliminary work" allowed by SB 826.

G. chnical - It appears that more data is needed to resolve some potential geotechnical problems such as the relict channel. This may result in a design changes which are more expensive and/or not capable of generating as much energy.

H. Economic Life - The time horizon for the Susitna Project economic analysis extends from 1993-2051. The Watana Dam is assumed to have a 50 year economic life and to come on-line in 1993. Consequently, its retirement would be in 2043. It does not appear that costs for extending its life to 2051 are included in the present worth calculations. Also, the APA assumes an economic life of 20 years for transmission lines. The replacement costs for the Anchorage - Fairbanks Intertie (which are not included in the cost of the Susitna Project) and additional transmission lines needed for the Susitna Project, do not appear to be included in the present worth calculations.

II Battelle

A. Cock Inlet Gas - Battelle devoted considerable effort to assessing the availability of Cook Inlet gas. However, due to the confidentially of this information, substantial uncertainty remains. Perhaps the State has access to information which could improve the understanding of gas resources.

B. North Slope Gas - The availability of North Slope gas and the possibility of using this gas to generate electricity on the North Slope for transmission to Fairbanks needs to be explored. The Division of Budget and Management is taking a preliminary look at this option.

C. Revenue Projections - The load forecasts need to account for the recent decline in the States revenue projections. Battelle is now reviewing the most recent revenue projections and will estimate what effort is needed for revised load forecasts.

D. Forecasting Model - The MAP, RED and AREEP models need critical review. It does not appear that these models converge with actual data. Also the industrial development assumptions in Table A.1 should be reviewed based on current conditions.

E. Cost Breakdowns - It does not appear that the AREEP model can easily provide the cost data that is described in Figure 6.2 of the Executive Summary. This could be a serious deficiency if the model is applied to additional energy planning efforts. The PRC needs to have a better understanding of the AREEP model features and shortcomings before accepting State ownership.

F. Glennallen - Valdez - The PRC decided to include Glannallen - Valdez in the load forecasts but not to provide the area with Railbelt power. Battelle included the Allison Lake Project, near Valdez, in their project slate and presumably a transmission line to the Anchorage area. Consideration should be given to deleting this project from the power development plans.

G. Cogeneration & Waste Heat - Cogeneration and benefits from waste heat were not considered by Battelle. Consideration should be given to siting thermal plants near a market for waste heat.

H. Interest During Construction - Battelle did not include Interest During Construction in their project cost estimates. The significance of this cost is not as significant with the alternatives as it is with the Susitna Project due to shorter construction periods but nevertheless, needs to be accounted for.

SUSITNA HYDROELECTRIC PROJECT

TO: All Recipients of the Susitna Hydroelectric Project Feasibility Report

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Sincerely,

James O. Lee

for John D. Lawrence
Project Manager

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ALASKA POWER AUTHORITY

MEMO TO: Jim Souby
Director
Division of Policy Development
and Planning

Ron Lehr
Director
Division of Budget & Management

Lloyd Pernela
Director
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Executive Director
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MEMORANDUM State of Alaska

MAY 11 1982

BUDGET AND MANAGEMENT

TO: The Honorable Jay S. Hammond
Governor

DATE: May 11, 1982

FILE NO: 1G.13

TELEPHONE NO: 465-3577

FROM: James M. Souby, Director
Division of Policy Development
and Planning
Office of the Governor

SUBJECT: Conclusions from
Battelle Power
Alternatives Study

The following is a brief summary of the significant results and questions arising from the Battelle Railbelt Alternatives Study. You were briefed on these issues Thursday, April 29, 1982, by the Policy Review Committee (PRC).

A. General Conclusions

1. Escalation of Fossil Fuel Prices

The report concludes that Susitna is economically attractive if the real price of fossil fuels escalates at 2% or more per year over the next 30 years. However, the economic benefit disappears if the real price of fuel increases at only 1% per year, particularly so if crude prices index at less than the $36.00 per barrel price assumed in the study.

One factor not considered in this analysis is that a lower fuel cost and rate of escalation will also result in a lower capital cost for the Susitna project. Though reduced capital cost due to lower fuel prices would also apply to other supply alternatives, such reduction would seem to be greatest for Susitna since it is the most capital-intensive supply option. The significance of these capital cost reductions will have to be explored if lower fuel costs prevail.

2. Capital Cost Overrun

The report concludes that the economic benefit of Susitna disappears in the event of a 20% capital cost overrun. Opinions on the probability of such an overrun vary widely. A separate cost estimate has been prepared for the Susitna project which provides different figures for certain cost components, though the estimates of total cost in both cases is very similar.

The memory of huge cost overruns on the Trans-Alaska Pipeline is still fresh. On the other hand, there are many capital projects in the world, including some in Alaska, that have been built on or below budget. The PRC members do share a sentiment that government willingness to assume the economic risk of a project would increase the probability of capital cost overrun. In any event, confidence in the capital cost estimate cannot be increased without additional study.

3. Electricity Demand Growth

Demand growth that is sufficient to absorb the output of Susitna is important to project economics. The study concentrates on a "medium" demand growth scenario (the mean estimate) which reflects an expected level of economic and population growth in the Railbelt based primarily on last year's projections of State government revenue and expenditure. These projections have now declined to a level at or possibly below the report's "low" demand growth scenario. If today's projections now constitute the expected case, then additional work should be done to test the project economics under a new, lower than expected case.

The report indicates that all or nearly all of the output from one half of Susitna (the Watana dam alone) could be quickly absorbed, even if the rate of demand growth is "low" (i.e., today's expected case). However, under the report's "low" growth scenario, construction of the second half of the project (the Devil Canyon dam) would be deferred for an indefinite time. The report indicates that, assuming "low" demand growth, Watana alone is still marginally superior to thermal generation over the long run, even though the capital cost per installed kilowatt of capacity is twice as high for Watana than it is for Devil Canyon.[1] However, the combined effects of low demand and low fossil fuel costs and escalation could easily affect this conclusion. These combined effects were not examined by Battelle.

The report also concludes that electricity demand is very sensitive to price. When the price of power is calculated assuming no capital cost recovery, the projection of electricity demand in 2010 is approximately twice the level projected when capital cost recovery is included in the rate. One implication of this price "elasticity" of demand is that additional generation facilities and attendant financing may be required sooner than would otherwise be necessary.

4. Project Timing

The report assumes that the real cost of capital construction will increase at 1.4% per year, while the mid-range assumption for the real rate of fuel price increase is 2% per year. Based on these assumptions, it might appear that Susitna becomes increasingly attractive as time goes on, since the primary component of Susitna cost is projected to increase less rapidly

[1] The Watana dam, with its large reservoir, would have to be built first since the small reservoir to be created downstream at Devil Canyon is inadequate by itself to provide for required flow modulation.

than the primary component of thermal cost. However, the report concludes that a five-year delay in Susitna reduces its relative economic advantage over thermal generation. The reason for this may be the application of a real discount rate to reflect the "time preference" for economic benefits. As a result of the discounting procedure, a somewhat higher absolute benefit received in the future may be worth less than a lower absolute benefit received today. This conclusion has to be weighed against high interest rates prevailing today, however.

Another aspect of the timing question concerns the need for State financial participation. The need for such participation has, to some extent, been based on the objective of reducing the early year price of Susitna power to a level competitive with thermal generation. However, if the price of thermal power is increasing at a faster rate than the capital cost of Susitna, then at some point the early year rate of Susitna should be competitive with thermal power even in the absence of State financial participation. In other words, a delay in Susitna may reduce the need for State financial participation. However, the report does not address this issue, and the PRC has not agreed on whether this is in fact the case.

We do agree, though, that massive revenue bonding should not take place until interest rates are substantially lower than they are now. In addition, it would be prudent to defer a commitment decision on the project until the long run price trend of oil, State oil revenues, and consequent economic growth in the Railbelt can be projected with greater confidence than we have today. We would generally concur with the recommendations of the External Review Panel to the APA on the issue of awaiting a favorable economic "window", but in terms of the Susitna project proving to be the lowest cost alternative as well as in terms of Susitna project financing.

5. Environmental Concerns

The study made no attempt to quantify the environmental impacts of the various alternatives. There is still a considerable dispute on the extent of pollution impacts from thermal generation given the latest technology, and also on the habitat impacts of the Susitna project and the prospects for mitigation.

6. Conservation

An unresolved policy question is whether State energy subsidies would be better spent on conservation investments or on additional generating capacity, or on both (or neither). The report does not indicate whether one State dollar spent for energy conservation would yield more or less benefit than one State dollar spent for

additional power generation. One estimate developed in conjunction with the study indicates that the cost of building insulation sufficient to conserve one kilowatt of power is lower than the cost of installing one additional kilowatt of generating capacity. Though the cost estimate for conservation has been criticized as being too low, investment in conservation would still appear competitive with the cost of generating capacity even if the estimate were doubled. The issue is not well understood, but does merit additional consideration.

7. Gas Availability in Cook Inlet

The consequences of delay in Susitna may be less serious if gas reserves in Cook Inlet turn out to be significantly higher than previously expected. Recent information obtained from the Pacific Alaska LNG sponsors suggests that this may indeed be the case. Additional information from the Pac LNG sponsors has been requested.

B. Recommendations

The Acres study provides a site specific analysis of the Susitna project. The Battelle study initially assessed most possible alternatives to the Susitna project, screened out the least likely, and provided reconnaissance level data on 21 alternatives. The Battelle study was not intended to provide site specific data nor select the most viable alternative to the Susitna project. Consequently, it is not possible, at this time, to make a defensible comparison between the merits of the Susitna project and its most likely alternative.

In addition to answering the questions raised by the study, further analysis is needed to determine which project or combination of projects comprise the most likely alternative and provide site specific data. These studies will: 1) expedite the Susitna project decision process by reducing the number of unknowns; 2) assure that the cost data for the most likely alternative has a high level of confidence; 3) assure that the final project selection does result in the lowest cost power to Railbelt consumers and the State; and, 4) assure that the project selection process complies with State statutes and regulations.

The alternatives for further study have been narrowed down to the following:

1) North Slope Gas - a two phase study is recommended which will evaluate the technical, environmental and economic feasibility of using North Slope gas for power generation. The first phase ($200.0) will provide a site specific review of the generation and transmission facilities that would be needed and will estimate their cost. This phase will consider

a transmission line from Prudhoe Bay to the Railbelt, and will also explore the possibility of a small gas pipeline to provide a supply of natural gas to the Fairbanks area. The review will include an evaluation of the availability and price of North Slope gas including institutional considerations. If the first phase proves attractive, a more detailed study ($800.0) will proceed which will concentrate on the transmission corridor.

2) Beluga Coal Generation - Both the Acres and the Battelle study assumed that the availability of Beluga coal was dependent on the development of an export market. Some question this assumption, pointing out that domestic consumption may not require the same level of investment in infrastructure. It is recommended that $100.0 be spent to provide a more detailed and site specific review of the costs for Beluga generation. This effort will concentrate on data from other studies including previous utility studies. This study would provide a cost estimate for an environmentally acceptable coal generation facility at Beluga.

3) Chakachamna Hydroelectric Project - Chakachamna appears to be the largest potential hydroelectric site which is cost-competitive with the Susitna project. Previous studies have provided reconnaissance level data, but more intense field studies are needed to achieve feasibility level data on the costs and possible environmental impacts of the site. The Alaska Power Authority has recommended that $3,300.0 be appropriated for this effort.

A total of $4,500.0 is recommended for FY83 alternative studies. It would be desirable to have this as one appropriation with allocations to each of the three alternatives. This would allow transfer between allocations if an adjustment in funding levels becomes appropriate.

The Department of Natural Resources should be asked to conduct a natural gas assessment for Cook Inlet. New probabilistic techniques within the Department could help to further understand the gas potential for this region. The PRC will undertake the further analysis suggested in the general conclusions.

cc: Members of the PRC:

Chuck Conway, APA
Ron Lehr, B&M
Bill Beardsly, DEPD

bcc: George Hatz, B&M
Eric Yould, APA
Dick Emerson, DPOP
Bill Luria, DPOP

JS/PE/pa

Project Title	Location(s)	Election Districts Served	Start Date	Completion Date
Susitna Hydroelectric Project	Railbelt, Alaska	D-K, O, 6-13 20	July 1982	2000

AGENCY REQUEST			Operational Cost & No. Personnel Increase -- (Decrease)		First Operating Year 83	Ultimate Annual Year 2000	GOVERNOR'S REQUEST Approved	Deferred	Disapproved
1002	Federal Receipts		Funding Source	Federal Receipts			1002 Federal Receipts		
1003	G/F Match			General Fund			1003 G/F Match		
1004	General Fund	25,600.0		Project Revenues	To be determined		1004 General Fund		25,600.0
1005	I/A Receipts						1005 I/A Receipts		
	G.O. Bonds		Total Annual Operational Cost				G.O. Bonds		
			Position (FTE)						
			Previous Year-Priority	Agency Priority	Governor's Priority				
	Total	25,600.0	82-1	83-13			Total		25,600.0

PROJECT DESCRIPTION

The purpose of this budget amendment is to provide the Legislature with a current expenditure plan regarding the development of the Susitna Hydroelectric Project.

The Governors FY 83 Capital Budget Request includes a request for $25,600.0 to continue the Susitna Hydroelectric Project planning efforts and the initial phase of project design. This request was submitted before completion of the Susitna Hydroelectric Project Feasibility Report by Acres and the Railbelt Electric Power Alternative Study by Battelle. These studies are now mostly complete, allowing for a more current description of how this appropriation is expected to be used in FY 83.

The Acres feasibility study provides a comprehensive assesment of the geotechnical, hydrologic and seismic considerations of the Susitna River site. Based on this information a number of design options were studied and an optimal design has been selected. However further information is needed to assure that the project is properly designed. It is not expected that any modifications which may result from these studies will result in any increase to the estimated construction costs.

State and federal agencies and the public have had an opportunity to review the Acres and the Battelle studies. As a result of this review, it became apparent that before a FERC license application is submitted, the environmental data should be improved and information on alternatives should include a narrower range of options and be more site specific. Plans are now being developed to provide this information. Also, due to a number of objections expressed by agencies, access to the project site is being reevaluated.

Expenditures will also be made for additional transmission studies, cost estimating, scheduling, financing, camp operations, logistical support, and project management.

35a **PROJECT DESCRIPTION – PROPOSED CAPITAL PROJECT**

01-1143(7-81)

CATEGORY Power Development

AGENCY Alaska Power Authority

PROGRAM Energy Development

Revised Date May 10, 1982

FY 83

Project Title	Location(s)	Election Districts Served	Start Date	Completion Date
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1004	General Fund	25,600.0		Project Revenues	To be determined		1004	General Fund	25,600.0
1005	I/A Receipts						1005	I/A Receipts	
	G.O. Bonds		Total Annual Operational Cost					G.O. Bonds	
			Position (FTE)						
			Previous Year Priority	Agency Priority	Governor's Priority				
	Total	25,600.0	82-1	83-13				Total	25,600.0

PROJECT DESCRIPTION

A decision will soon be made regarding the best time to submit a FERC license application for the Susitna Hydroelectric project. This decision will be largely based on the adequacy of the information used to support the license application. Preparation of the license application will require additional expenditures.

Detailed design will begin when the FERC license application is submitted. This will require some expenditure during this fiscal year but most of the detailed design expenditure will occur after FY 83.

35a **PROJECT DESCRIPTION – PROPOSED CAPITAL PROJECT**

CATEGORY Power Development

AGENCY Alaska Power Authority

PROGRAM Energy Development

Revised Date May 10, 1982

FY 83

01-1143(7-81)

April 15, 1982

REPORT TO
BOARD OF DIRECTORS, ALASKA POWER AUTHORITY

From

EXTERNAL REVIEW PANEL, SUSITNA HYDROELECTRIC PROJECT

After reviewing the comprehensive Feasibility Report prepared by Acres American Inc., the External Review Panel offers to the Alaska Power Authority the following unanimous comments on the proposed Susitna Hydroelectric Project:

1. It is recognized that the project will have environmental impacts on wildlife, fisheries, and botanical resources. However, the extent and severity of these impacts appear to be relatively small and furthermore many of these environmental losses can be mitigated in full or in part.

2. The high dams proposed for Watana and Devil Canyon can be designed to safely withstand the maximum anticipated earthquake forces.

3. The proposed design adequately responds to the hydrologic environment in terms of spillway capacity and dependability.

4. If the project is financed at an opportune time when bond interest rates and oil revenues are favorable, the potential long term benefits of the Susitna project will be considerable.

5. Accordingly we consider that the overall impact of the project on the State of Alaska could be attractive.

6. To this end we endorse the plan to apply in September 1982 for a permit from the Federal Energy Regulatory Commission.

7. Moreover, we endorse the proposal to proceed with site investigations and design of the project, with concurrent work on some of the critical environmental studies, particularly those concerning downstream effects of the dams on the stream and its fish life.

8. The arrival of any opportune time to proceed with construction will depend on critical issues of finance and marketing of power which cannot now be accurately forecast. Our recommendation is that tender documents with all supporting geotechnical investigations and design studies be developed. We estimate that a total period of three to four years will be required for this phase of work. The project will then be ready to be implemented whenever the financial climate for contracting becomes favorable. The advantages of proceeding in this manner are:

(1) The economic benefits of being ready for financing;
(2) the momentum of the ongoing study and an informed staff; and
(3) the ability to avoid a crash design program.

The disadvantage is the small risk of loss of the design costs in the event that, for some reason, the project is never built.

9. We recommend that the Alaska Power Authority develop a detailed business plan which incorporates financing and marketing plan into an overall business strategy. The plan would describe the critical events that need to be accomplished, the interrelationship of these events, the approach to accomplishing these goals, the management and control practice that are appropriate, the most economic financing strategy, and power alternatives if the Susitna project is delayed or the demand forecast changes.

10. This Panel is of the opinion that the economic climate will eventually indicate that it is advisable to proceed with the construction of the Susitna project and at that time it will be in the best interests of the State of Alaska to develop this important natural resource.

Merlin D. Copen

Andrew H. Merritt

Jacob H. Douma

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A. Starker Leopold

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ALASKA POWER AUTHORITY

334 WEST 5th AVENUE - ANCHORAGE, ALASKA 99501

Phone: (907) 277-7641
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April 14, 1982

Mr. Charles Conway, Chairman
Alaska Power Authority
334 West Fifth Avenue, 2nd Floor
Anchorage, Alaska 99501

Dear Mr. Conway:

In response to your letter of February 3 to members of the Alaska Power Authority External Review Panel for the Susitna Project and your request for a critical evaluation of the Acres American Inc. Feasiblity Report and findings and the responses of individual Panel members to specific questions, we offer the following attached comments on the various aspects of the study.

It has been a pleasure working with members of the Alaska Power Authority staff and Acres American, Inc. on this important study and we would like to express our appreciation to you and all concerned for the help and support we have received in preparing our reports and recommendations over the past two years.

Sincerely,

EXTERNAL REVIEW PANEL
MEMBERS

Merlin D. Copen

Jacob H. Douma

A. Starker Leopold

Andrew H. Merritt

Dennis M. Rohan

H. Bolton Seed

Attachment: as stated

ENVIRONMENTAL CONSIDERATIONS

Development of the Susitna Hydroelectric Project will impact the environment of the Susitna basin in a number of ways. The two reservoirs will inundate substantial areas which now support forests and some kinds of wildlife; the construction camps, roads, and transmission lines will disturb various upland ecosystems; and the flow of the Susitna River below the dams will be modified as salmon spawning and rearing habitat. A number of on-going studies have shed considerable light on existing animal populations and vegetational types. Although some information is still far from complete, it is possible now to anticipate some of the impacts that the project will impose on these communities. In the aggregate, the total impact will be relatively small. Moreover, by judicious management, it will be possible to mitigate some of the habitat losses by improving habitats elsewhere. The discussions which follow summarize the environmental problems as they are now understood.

Reservoir Areas

The two impoundments, with an aggregate area of about 71 square miles, will obviously be converted from terrestrial to lacustrine habitat with a loss of all the plants and wildlife that use these areas now. Among the larger animals whose numbers will be reduced are moose, black bear, and several species of mustelid fur-bearers. A wide variety of small birds and mammals will be evicted. Yet most of these species are common in this part of Alaska; there are no known endangered species of either plants or animals. In the case of the moose, it is proposed to manipulate vegetation along the lower Susitna, by burning or mechanical means, to create more winter range and hence to increase moose populations there to compensate for losses of moose in the impoundment areas. A somewhat reduced moose population in the upper Susitna basin might mean some reduction in the dependent wolf population. The Watana impoundment intersects a migration route used by the Nelchina caribou herd. Although caribou swim well, and easily cross natural water barriers, there is a possibility that ice shelving along the shore of the Watana reservoir might interfere with caribou movements. If such a problem is detected, the ice shelf could presumably be blasted. Of greater importance, perhaps, is the necessity to clear and remove all the timber from the impoundment areas to preclude the formation of floating log jams that could create a truly dangerous barrier to migrating caribou.

The upper Susitna River supports several native fish, of which the grayling is the primary game species. Although the river habitats that are inundated will be lost _ grayling production, it is possible that the reservoirs themselves may support modest populations of grayling and perhaps lake trout.

Downstream Effects

Below the Devil Canyon dam the flow of the river will be substantially altered from its natural cycle. High summer flows will be captured in the reservoirs to supply winter discharge. The reduced summer flows in the river might adversely affect salmon spawning and rearing habitat as far downstream on the confluence with the Chulitna River, near Talkeetna. Side sloughs that are used as spawning areas by chum and sockeye and as rearing areas by juvenile coho and chinook will be cut off from flushing flows which normally occur at high levels of discharge. Considering the total runs of salmon that spawn in the Susitna drainage and its tributaries, the proportions that utilize the reach between Talkeetna and Devil Canyon are as follows (figured from Schmidt and Trihey):

Species	Total Susitna runs (approx.)	Percentage spawning above Talkeetna
Coho	33,000	8%
Chinook	76,000	2%
Sockeye	340,000	1%
Pink (odd years)	113,000	3%
Chum	286,000	15%

Chum and coho salmon are the two species that might be adversely affected by construction of the dams. There are good prospects for mitigation of those potential losses. Thirty-two sloughs have been identified along this stretch of the river. Mechanical opening of intake channels might permit flushing flows at discharge levels planned for normal power production. Occasional higher flows might be released, if needed. Additionally, artificial spawning channels might be constructed. If proper multiple outlet structures are installed in the dams, water temperature can be regulated as well as flows. Much of the silt in the upper river will settle in the reservoirs, resulting in clearer water flowing from Devil Canyon dam, which may be highly advantageous for rearing of young salmon. All of these mitigation measures could preserve the salmon runs at nearly pre-project levels, or potentially at even higher levels. Below Talkeetna, no significant changes in the salmon habitat are anticipated.

Elimination of peak floods may result in stabilization of bars, islands, and river banks in the river bottoms below Devil Canyon Dam, with the result that riparian forest may develop in areas now in willow brush. Such advance in plant succession will be unfavorable to moose, since willow is a prime winter food. This trend can be reversed by a program of logging of the bottomland forest or by judicious controlled burning.

Summary

Considering the environmental impacts as a whole, and the possibilities for partial mitigation, it does not appear that environmental considerations should preclude the development of the Susitna Project.

GEOTECHNICAL CONSIDERATIONS

General

The External Review Panel, as a group and individually, has visited the proposed dam sites, inspected the rock formations, reviewed the results of the exploration program, and read the interpretations and conclusions presented by Acres in their Feasibility Report. We recognize that the site exploration has been done in various stages over the past years and note that the Feasibility Report has included the pertinent portions of these earlier studies.

We conclude that the amount of site geologic investigations completed for the Feasibility Report is adequate to effectively preclude unknown geotechnical conditions which would have a major adverse impact on project design and costs.

Geology and Project Layout

The geologic conditions revealed in outcrops and borings are generally very favorable for the structures required for the project. Where local shear zones or other areas of poorer quality rock have been identified, the proposed project features have been positioned to avoid them to the degree possible. For example, the diversion tunnel inlet structure at Watana has been moved downstream to avoid the "Fins" feature, the major underground chambers at Watana have been moved to the right abutment to avoid the "Fingerbuster" shear zone, and the orientation of the open cuts and underground chambers have been located where possible to obtain the most favorable orientation with respect to the joints and shear zones and thereby avoid major rock stability problems.

The very good rock conditions revealed in the borings are favorable for the major underground openings proposed and we foresee that the excavation and support of the chambers will proceed using well established construction methods. We expect that subsequent exploration will provide the information required to establish the most favorable final position for the chambers as well as providing more detailed information on the most appropriate excavation and support methods for the large diameter tunnels and high slopes.

Special Geologic Conditions

The results of the exploration program at both sites have revealed no geologic structures that can not be handled by conventional methods. Moreover, the field work has been sufficiently widespread to embrace the general geologic conditions so that no major adverse feature is likely to have been overlooked.

One of the most important geologic aspects that will receive careful attention during future field work is the buried or relict channels on both abutments at Watana. To date the studies have identified a deep channel on the right side that passes between Deadman's and Tsusena Creeks that has been filled with varied glacial deposits. The geometry of the channel and general nature of the deposits have been defined by geophysical surveys and borings. More recent studies on the left side in the Fog Lakes areas indicate that a similar channel exists here also.

The importance of this channel and its deposits for the Watana site are threefold: 1) magnitude of seepage, 2) piping of materials towards Tsusena Creek, and 3) seismic instability of the soils under strong earthquake shaking. These items have been fully addressed in our meetings with Alaska Power Authority and Acres and among other items, modifications have been made in the level of the reservoir to decrease the height of water against the saddle dike on the right side. It is clear that further field studies are required (and are planned) to assess the importance of the above mentioned three factors. However, as has been clearly pointed-out in previous reports, we believe that there are technically and economically viable solutions to these potential problems. Acres and their External Review Panel hold the same opinion. For the various possible solutions, estimates have been developed and are reflected in the project costs. We believe that the estimate is reasonable and should cover possible contingencies that may develop as more information becomes available.

SEISMIC DESIGN CONSIDERATIONS

The Susitna Project is clearly located in an area of potentially strong seismic activity and must be designed to safely withstand the effects of earthquakes. For this reason, a greater than normal effort has been devoted during the feasiblity studies to determining the pos-

sible sources and magnitudes of seismic events which could affect the project and the intensity of shaking which these events could produce at the proposed sites for Watana Dam and Devil Canyon Dam.

The extremely comprehensive studies of the seismicity of the project area are probably more extensive than those conducted for any other hydropower project in the world. They have been conducted by a highly competent group of earth scientists and engineers and they have identified the major potential sources of seismic activity, the potential magnitudes of earthquakes which oculd occur on these sources and the levels of ground shaking which could occur at the project sites as a result of the largest earthquakes likely to occur on these sources.

Design ground motions for the required studies have been selected with a degree of conservatism appropriate for critical structures, taking into account the possibility of a great earthquake (Magnitude 8.5) occurring on the Benioff Zone underlying the dam-sites as well as the possibility of local earthquakes (Magnitude about 6 1/4) occurring within a few kilometers of either of the sites.

Watana Dam

The preliminary design of the Watana Dam is a high embankment dam with gravel shells and an impervious central core. The design is similar to that successfully used for other very high dams (Oroville Dam in California and Mica Creek Dam in British Columbia, for example) and generally considered to be the most desirable for embankment dam construction. Sources of the required types of soils have been located and investigations have shown that ample quantities are available.

The proposed section of the dam is appropriately conservative with a proven capability to withstand normal loadings and excellent characteristics to enable it to withstand any anticipated earthquake loading. The proposed design is in fact very similar to that of Oroville Dam in California which has probably been subjected to more detailed analysis of seismic stability than any embankment dam in the world. These studies have shown that the Oroville Dam would be stable even if a Magnitude 8 1/4 earthquake should occur within a few kilometers of the dam-site. The controlling design earthquake for Watana Dam is comparable in magnitude but is source is located about 65 kms from the Watana site so that the shaking intensity is less than that used in the Oroville Dam investigation. Furthermore, the proposed materials for construction of the upstream shell of Watana have equally desirable characteristics as the Oroville Dam shell materials. Consequently, there is no reason to doubt, and preliminary analysis by Acres American, Inc., confirm that, with appropriate attention to engineering details, the proposed Watana Dam section will be able to withstand the effects of the conservatively evaluated earthquake shaking with no detrimental effects.

Devil Canyon Dam

The proposed design of Devil Canyon Dam is a concrete arch and an evaluation of the design is presented in the following section. With regard to earthquake-resistant design, dynamic analyses have been made to determine the stresses developed by conservatively-selected design earthquakes: a magnitude 8 1/2 event occurring at a distance of 90 kms and a local earthquake of magnitude 6 1/4 occurring very near the dam-site. The computed stresses are with the acceptable limits for concrete arch dams.

Furthermore, the ability of such dams to safely withstand extremely strong earthquake shaking has been demonstrated by the excellent performance of the Pacoima Dam in California in the San Fernando earthquake of 1971. This 350 ft. high dam safely withstood the effects of a Magnitude 6 1/2 earthquake occurring directly below the dam and producing some of the strongest earthquake motions ever recorded. This full scale test of a prototype structure provides convincing evidence that such dams can be designed to safely withstand the effects of strong earthquake shaking.

Other structures

In final design careful attention will have to be given to the earthquake-resistant design of other features of the project including spillways, powerhouses, intake structures, etc. The safe design of these structures is well within the state-of-the-art of engineering design for the anticipated levels of earthquake shaking and should present no major problems with regard to unacceptable levels of damage or public safety.

Uncertainties in Design

Probably the greatest uncertainty with regard to seismic design is in the required treatment of the buried channel on the right bank of the Watana reservoir. This uncertainty stems mainly from the fact that it has not been possible at this stage of project development to ascertain by borings the types of soils filling the buried channel and their engineering characteristics.

However, this is not a major problem since even if very unfavorable characteristics are assumed for these soils (and this will not necessarily be the case), remedial design measures have been explored and developed to eliminate any problems which could arise. Provisions for the costs of these measures are included in the cost-estimate even though the mitigation measures themselves, which may not be required, are not presented in the feasibility design reports.

Conclusion

In summary, it may be stated that the feasibility studies for the Susitna Project included an extremely comprehensive investigation of the seismicity of the project area and the development of design concepts for the major critical structures which, with appropriate attention to details in the final design and construction, should certainly eliminate any concerns regarding the provision of an adequate level of public safety and the prevention of any significant damage to the project as a result of earthquake effects.

DEVIL CANYON DAM

The Devil Canyon Damsite is ideally suited for an arch dam. The canyon is narrow and V-shaped. The abutment rock is sound and competent.

Devil Canyon arch dam has been designed and analyzed by use of the Arch Dam Stress Analysis System (ADSAS) computer program, which is the computerized version of the Trial Load Method of Analysis. This method was developed by the U. S. Bureau of Reclamation and has been thoroughly examined by rigorous mathematical analyses. In addition, results from this method have been successfully compared with structural models and prototypes in service.

The design selected for Devil Canyon is a thin double curvature arch. It is curved in both horizontal and vertical planes to produce the most efficient distribution of stresses possible under the site and loading conditions to which it may be exposed at this site.

The static loading conditions examined are the most severe combinations of gravity, reservoir and temperature loads anticipated at the site. The resulting stresses indicate a factor of safety greater than four, based on the anticipated compressive strength of concrete in the structure. The maximum tensile stresses occur on the downstream face of the arch, where, if cracking were to occur, no damage would result. The magnitudes of tensile stresses indicated will not occur since a redistribution of load in the dam will result as such stresses develop.

The dynamic loads applied to the dam are considered to be very conservative. Even so the resulting stresses will not cause serious damage to the structure. The analytical method used for stress studies is based on elastic theory. If the stresses indicated should occur, contraction joints in the upper part of the dam may open momentarily but would not result in major release of water or permanent damage to the structure.

The preliminary design for Devil Canyon Dam does, in every respect, respond to the seismic environment of the site.

With proper construction control, the dam will provide adequate safety under all loading conditions. It is extremely important that the very best construction techniques be employed in this dam. Proper concrete mix designs, consistent consolidation of the concrete and careful treatment of the rock contact and construction joints are of the utmost importance. The resulting concrete must be a homogeneous and isotropic product.

There are always risks of inadequate or inconsistent construction practices which would present problems in the behavior of a dam. Fortunately an arch dam has the capability of distributing load from weak areas to stronger, more capable concrete. This is not meant to excuse any but the best concrete control possible, because any weaknesses are not acceptable in this important structure.

Additional foundation investigations and insitu measurements will be required before a final design for Devil Canyon Dam is completed. Deformation moduli, joint orientation and continuity, and shearing resistance along joints will be required. Because of the preliminary nature of the present studies, such investigations are not considered necessary at this time. Instead, conservative assumptions have been made to assure a safe and satisfactory structure.

The proposed foundation treatment, consisting of consolidation and curtain grouting and adequate drainage, is satisfactory.

The engineering consultant has used adequate conservatism throughout the design for Devil Canyon Dam. Very little change from the preliminary design is anticipated for a safe and efficient final design for Devil Canyon Dam.

HYDROLOGY AND HYDRAULIC DESIGN CONSIDERATIONS

Flood Potential

The engineering consultant's assessment of the flood potential in the project area has properly identified the potential magnitudes and frequencies of flood flows.

The assessment utilized all available precipitation, snow survey and stream gaging data for stations within and adjacent to the Susitna River Basin. The probable maximum flood is based on the most critical combination of precipitation, snow melt, infiltration losses and flow

concentrations that is reasonably possible. The hydrologic analyses are in accordance with accepted engineering practice which has been developed in the United States and is being used in many parts of the world.

Spillway Capacity and Dependability

The proposed design adequately responds to the hydrologic environment in terms of spillway capacity and dependability.

Both Watana and Devil Canyon dams will have low-level valve-controlled outlets to pass the once in 50-year flood, a gate controlled chute spillway in combination with the valve outlets would pass the once in 10,000-year flood and a fuse plug emergency spillway in combination with the valve outlets and chute spillway would pass the probable maximum flood without overtopping the dams. Similar valve outlets and emergency spillways have been constructed and operated elsewhere with successful service. There is no reason to believe that they would not be successful at the Susitna project.

Public Flood Safety

The proposed project adequately protects public safety in terms of the flood danger and there are no increased flood risks inherent in building the project.

The reservoirs will be drawn down in winters providing significant amounts of reservoir capacity for storage of summer floods. Virtually all normal river flows would pass through the powerhouses with very little spillway operation. Peak discharges for major floods would be reduced substantially. Consequently, project operation would enhance the public safety by reducing the magnitude and danger of floods in the lower Susitna River.

Spillway capacities and heights of dams are designed with conservative safety factors. The dams and water conveyance structures are designed and would be constructed with high safety factors in accordance with best engineering practice. For these reasons, there would be no increased flood risk inherent in building the project.

Project Damage or Shutdown

There is no reason to expect that the project would experience damage and/or require shutdown as a result of floods.

Major floods may cause some cavitation erosion in spillway chutes, river bank and bed erosion downstream of flip buckets and valve outlets, and erosion in the unlined emergency spillway channel.

Because of the infrequent occurrence and relatively short duration of major floods, none of these types of damage would become so extensive during any single flood to require project shutdown.

One or more of the valve controlled low-level outlets may sustain damage during a major flood requiring temporary shutdown for repairs. This shutdown would not significantly affect flood regulation since each outlet discharges a small percentage of the total flood flow.

As the powerhouses will be underground, floods would not cause them to be damaged or shutdown.

Design and Operation Assumptions

The engineering consultant has not made any major assumptions regarding design, operational mode, etc. of water conveyance structures that lack a satisfactory level of conservatism.

The low-level outlets, main spillways, and fuse plug emergency spillways have all been designed in accordance with current engineering practice which is based on conservative assumptions. Fixed cone valves are superior to any other type of valve for high-head operation. Air slots will be provided in spillway chutes to prevent cavitation erosion by high velocity flow. Pre-excavated plunge pools and/or bank protection will be provided downstream of flip buckets and fixed cone valves to prevent excessive streambed and bank erosion. The fuse plugs are designed conservatively to withstand reservoir pressures until they are overtopped and then wash out rapidly to activate emergency spillway operation. The assumption that excessive erosion would not occur in the unlined emergency spillway channel is conservative in view of the mild channel slope and favorable rock quality.

The proposed operation of the water conveyance structures is believed to be the most reasonable and practical operational mode which provides a satisfactory level of conservatism with respect to downstream effects and project safety.

Reservoir Sedimentation

The effects of reservoir sedimentation have been properly assessed in design of the project.

Based on conservative values of the sediment inflow and reservoir trap efficiency, less than 5 percent of Watana reservoir would be filled in 100 years, and deposits in Devil Canyon would be less than 25 percent of that deposited in Watana reservoir. A large percentage of the sediment would be deposited in the dead storage portion of the

reservoirs. Reservoir sedimentation is not a controlling factor in project design as larger reservoirs or higher dams are not required and power production due to reservoir sedimentation would not be affected for well over 500 years.

Potential Downstream Effects

The proposed design and operation of the water conveyance structures adequately addresses potential downstream effects on river morphology, fisheries and wildlife.

Multi-level intakes will be provided for the power intakes and/or low-level outlets, as necessary, to permit release of reservoir water in the temperature range suitable for the downstream fishery. The valved outlets will discharge into relatively shallow basins, thereby preventing nitrogen supersaturation conditions harmful to fish. Spillway flip buckets and plunge pools will be designed to minimize nitrogen supersaturation. Their infrequent operation of once in 50 years would also greatly reduce any potential for serious effects on fish by nitrogen supersaturation. Planned increased reservoir releases during critical spawning periods together with remedial river channel work in spawning areas would minimize detrimental effects caused by lower river water levels due to project operation. While turbidity levels of reservoir releases would be sharply reduced in the summer, winter turbidity levels may be above natural levels due to suspension of fine sediments in the reservoirs; but this is not believed to be significant. Project operation will cause the following addtional effects in the Susitna River downstream of Devil Canyon Dam:

1) Eliminate and/or reduce thickness of ice cover for 20 to 30 miles downstream of Devil Canyon Dam in the winter due to release of reservoir flows above freezing temperatures which would prevent river crossings over ice by some wildlife and humans.

2) Sediment loads would be reduced in the Susitna River upstream of the confluence with Talkeetna causing some degradation of river channels.

3) Sediment loads would be essentially unchanged below the confluence because of the extremely large volume of sediment in the flood plain and contributed by tributary streams below the Talkeetna confluence.

4) Summer water stages in the lower Susitna River will be reduced by 1.5 to 3.5 feet which would reduce flooding in some areas and should not cause major impacts on navigation and other river operations.

5) The lower river will become more stabilized, resulting in a decrease in the number of small subchannels and an increase in vegetative cover.

6) The absence of annual floods may result in some loss of new lands for moose browse.

In summary, the potential downstream effects do not appear to be of such significance as to seriously jeopardize project construction.

Mitigation Measures in Water Conveyance Structures

Based on successful experience at other projects, mitigation measures that will be incorporated in the design of the water conveyance structures should be reliable and effective.

Multi-level intakes would have ports at several reservoir levels and a gate control system which would permit reservoir water to be released at the best possible temperatures suitable to the downstream fishery. The fixed cone valve sizes and operating heads for the Susitna project are well within their acceptable limits. Additional reliability of operation is provided by the use of 5 and 6 valved outlets at Devil Canyon and Watana, respectively. This enables continued operation at a high level of reservoir release in the event that one or two outlets would need to be closed. Operation of the valved outlets, as proposed, will reduce operation of the main spillway to once in 50 years, thereby reliably and effectively minimizing nitrogen supersaturation effects on the downstream river fishery.

Conclusions

In summary, it may be stated that the feasibility studies for the Susitna Project includes a thorough development of hydrologic aspects of the Susitna River and the development of design concepts for the major water conveyance structures which, with appropriate attention to details in the final hydraulic design, would assure an adequate level of public safety against flooding and the prevention of excessive detrimental downstream effects on river morphology, fisheries and wildlife.

MARKETS, ECONOMICS AND FINANCE FOR THE PROJECT

This section responds to the basic issues of the macroeconomic forces impacting the economic viability of the project, the future demand for power, economic measures and risks for the project, financial

opportunities and problems, marketability of power and suggestions for an overall strategy.

Macroeconomics

Two factors, future world oil prices and market rate of interest strongly impact (if not dominate) the economic and financial viability of the project. Both of these factors are in a large measure outside the control of the Alaska Power Authority.

Oil prices strongly affect the State's revenues, which in turn influence the State's economy, the rate of economic development in Alaska and correspondingly the future demand for power. These prices, through competitive market forces, establish the long run competitive price of natural gas and influence the price of coal and thus strongly influence the costs of thermal alternatives to the Susitna Project. These same prices affect State revenues and available funding from the State for the project, and the marketability of power.

More than 90% of the direct costs of operating a hydro facility are interest charges. The market rates of interest, thus strongly determines the cost of the Susitna Project and its relative economics.

The Susitna project is economically attractive in an environment of rising oil prices and low interest rates. Interest rates for State Government bonds are the highest they have been in fifty years. With a growing surplus of crude on world oil markets, the spot prices of crude have declined and future price trends are uncertain.

Demand For Power

We have reviewed the range of demand forecasts developed by ISER and Battelle and employed by Acres in their report and it is our opinion that these forecasts appear reasonable. Actual growth rates will probably lie between the expected and low cases. This is true because essentially all of the power will serve the residential and commercial market, which tracks population and employment trends.

Economics of the Susitna Project

The present value of the cost of the Susitna Project versus another source of power is related to the time horizon of the evaluation and the discount rate. The time horizon is important because the economics may be different depending on the period of evaluation.

Work done by Acres and Battelle, and supported by our independent evaluation show that over a 30 year period through the year 2010, the Susitna project would probably yield no net benefits. With current interest rates and oil prices, over a thirty year period, power from the Susitna could very likely be more costly than a thermal alternative.

However, hydro projects usually have long useful lives of many decades, and over a 60 year period, the Susitna project appears to be economically attractive.

With this framework, there is a value trade-off for Alaskans to choose between

* Receiving the current benefits from funds that would be invested in the Susitna Project

or

* Investing and receiving the potential long term benefits of hydro power in the next century.

Sensitivity and Risk Analysis

The net economic benefits for the Susitna project versus alternatives are highly sensitive to load forecasts, real discount rates, fuel escalation costs, capital costs of the project, and financing strategies.

For the Acres' base case analysis, which has escalating energy prices of 9-10% per year based on inflation of 7% per year and an implied interest rate of 10%, the net gain over a 60 year period is about $1.3 billion (1982). The investment in the Susitna Project corresponding to this gain is $5.1 billion (1982). If the load forecast follows a low growth scenario, the net gain is reduced to nearly zero, or if the discount rate is reduced to 12% (5% real) the project would yield a loss of $500 million or more.

If the fuel costs escalated at an inflation rate of 7% per annum, the impact would also be a loss of $1.1 billion dollars. Conversely, if the escalation rate for fuel is 10%, the impact would be a net sum of about $1.5 billion. If the capital costs of the project were 20% more than estimated, the cost of the Susitna Project and a thermal alternative would be essentially the same.

There is a wide range of possibilities for forecasts of these variables and corresponding values for the net benefits or losses. Through a probabilistic assessment of each of these variables, Acres estimated that there is about 25 - 30% chance for a net loss and a 70 - 75% chance for a net gain. These assessments were made in an

environment of increasing oil prices and medium increases in load, and did not directly account for the financing and marketing risks in these economic analysis. If we include these factors in todays environment, the risks increase although the weight of the economics still slightly favors the Susitna Project.

The major economic risks for the project are:

(1) Inability to obtain favorable bond rates and corresponding high financing charges for the project.

(2) Lower than expected energy price increases could make the project economically nonviable.

(3) Capital cost estimates may be too low, placing severe financial strain on the project.

(4) Possible opportunity losses, that is, foregoing the benefits of other investments in Alaska, for example, industrial development in enterprises which might generate net revenues or a stable long term employment base. The Susitna project would generate jobs during construction. However, in the long term during operation, the number of jobs added to Alaska's economy is minimal.

(5) Difficulty in entering into long term contracts for the power.

(6) A possible combination of the above.

Management of Economic Risks

Many of these risks can be managed, thereby substantially increasing the possibility of favorable economics for the project. The essence of this management is (1) timing and (2) additional low-cost studies.

A strategy of waiting patiently for favorable bond interest rates and an increase of oil prices would substantially reduce the risks. Taking a long term view, over say ten years, there is a strong possibility that interest rates will decline giving the Power Authority a window to obtain inexpensive financing. Correspondingly in the same time frame, it is likely that oil prices may start to rise again. In order to finance and start construction when these favorable events occur requires positioning now. This includes obtaining in advance all permits and licenses, and completing the engineering design and environmental studies.

To further reduce the risks, it is recommended that the Power Authority develop a business plan which would, among other things, identify viable power alternatives if the Susitna project is delayed or the demand forecast changes.

In the current inflationary environment, the Susitna Project would probably need state goverment participation of about 50% of the project's value -- $2,500,000,000 in 1982 dollars and more than $3,500,000,000 in actual costs. Because of the high level of risks, the debt portion of the project would probably require implicit or explicit state guarantees, or possible general obligation bonding. The State of Alaska effectively takes all the risk on the entire cost of the project including potential bonding of $2,800,000,000 in 1982 dollars and a correspondingly greater numbers of actual dollars.

A combination of escalating construction costs, high interest rates, and declining state revenues could put a revenue cash flow squeeze on the project. Positioning, patience and timing are critical to minimizing this risk.

These are some major opportunities in the financing area including the arbitraging of funds during the construction period or obtaining low cost debt financing. For example, if the project could be financed today at the lower rates that prevailed in 1977 and 1978 (7 to 8%), the present value of the costs could be reduced by about $1,500,000,000 (1982 dollars). A recurrence of low rates would markedly affect the financing of the project.

The tactics and strategy for financing needs further study and should be developed in the business plan.

Marketability

The power from the Susitna Project probably could not be sold unless it were less costly than alternatives. Anchorage, Fairbanks, and other regions within the Railbelt Area have different power sources and, correspondingly, different cost bases for power. This means that if uniform electric rates were used for Susitna power, the cost of power may be pegged to the least costly alternative. This would further exacerbate the financing and contracting problems.

A solution lies in organizational changes and a possible state referendum to gain support from the interested parties. This problem of marketing needs further study in the suggested business plan.

ALASKA POWER AUTHORITY

334 WEST 5th AVENUE · ANCHORAGE, ALASKA 99501

Phone: (907) 277-7641
(907) 276-0001

April 26, 1982

The Honorable Jay S. Hammond
Governor
State of Alaska
Pouch A
Juneau, Alaska 99811

Dear Governor Hammond:

Alaska Statute 44.83.300 mandates that the Alaska Power Authority prepare and submit a preliminary report recommending whether work should continue on the Susitna River Hydroelectric Project and on other viable alternatives. The law further directs the Authority to explain certain project aspects in detail, in the event of an affirmative recommendation. This letter and the accompanying materials constitute that preliminary report.

In formulating its recommendations, the Power Authority has reviewed the Acres American Draft Feasibility Report, has been briefed by Battelle Pacific Northwest on the results of the Railbelt Alternatives Study, has received an independent Susitna Project cost estimate, has received a final report from our Susitna External Review Panel, and has listened to public, agency and utility testimony about the proposed project.

The Board of Directors has concluded that the Susitna Project offers a potential of long term benefits to the residents of the State. While this potential exists, the realization of those benefits is dependent upon certain assumptions about the future that are far from certain, upon proper project development timing, and upon very skillful project management. Because of these uncertainties and the time available before any construction decision is necessary, the Authority believes it is premature to make any commitment, at this time, to actual project construction. On the other hand, since the potential exists for realizing substantial long-term benefits and since no information has come to light to suggest that environmental and social impacts, after mitigation, would be unacceptable, we recommend the following actions which were unanimously approved at the meeting of the Power Authority on April 22, 1982.

1. Pre-construction developmental efforts on the Susitna Hydroelectric Project should be continued;

2. The Alaska Legislature should authorize the Power Authority to submit a Federal Energy Regulatory Commission license application at a time deemed appropriate by the Authority. The issue of license application timing will be resolved by the Authority not later than June 30, 1982;

3. Funds in the amount of $25.6 million should be appropriated to the Authority in FY-83 for the continuation and intensification of environmental studies, for site exploration activities, and for the initiation of project design.

Ensuing Board discussions raised several additional issues. Assessment of selected alternative power generation options should be pursued in the event that Susitna development does not proceed as scheduled for one reason or another. Specifically, we suggest that an initial assessment be made of the technical viability, environmental impact and life cycle cost of a North Slope gas generation and transmission system to serve railbelt power needs, and that feasibility studies of the proposed Chakachamna Hydroelectric Project by continued. The estimated FY-83 costs of these activities are $200,000 and $3,300,000, respectively.

In as much as a substantial State monetary contribution (in the form of either a loan or a grant) will be necessary to offset the relatively high power cost in the initial years of project operation, State officials should carefully consider the alternative near term uses of these State funds that would be foregone.

The Authority wishes it be understood that the recommendation to continue development activities on the Susitna Project is not an endorsement of the consulting engineer's recommendations regarding specific project details. For instance, the engineer's plan for access to the project site is the subject of reanalysis and will be reconsidered by the Authority at an appropriate future time.

With respect to the detailed information required by AS 44.83.300, please reference the accompanying draft feasibility report and associated documents. The proposed conceptual design can be found in Chapters 11-14 of Volume 1. The phases of construction and the expected completion dates for each phase are presented in Chapter 17 of Volume 1 and on Plates 75 and 76 of Volume 3. This schedule represents an optimal program under the assumption of a mid-range load growth forecast. The actual commitment to begin construction will require continued assessment of the opportunities and constraints associated with financial markets, Railbelt load growth and State revenues. The expected cost of constructing each phase is shown in Chapter 16 of Volume 1. A second estimate, prepared at Power Authority direction independently of the consulting engineer is also provided. Finally, the anticipated costs to the State and to power consumers under a number of alternative methods of project financing are presented in Chapter 18 of Volume 1. Analysis must continue on these as well as other financing alternatives.

You will find additional very important information in the other sections of the draft feasibility report, in the independent cost estimate report, in the Susitna External Review Panel report, and in the transcript of public, agency and utility testimony.

The Power Authority appreciates the opportunity to provide this preliminary report and make these recommendations on the Susitna Hydroelectric Project.

Respectfully Submitted,

Charles Conway
Chairman

Attachments: As noted.

N.C.

UNIVERSITY OF ALASKA
Institute of Social and Economic Research
707 "A" St., Suite 206
Anchorage, Alaska 99501
Phone (907) 278-4621

February 24, 1983

Senator Vic Fischer
Senate State Affairs Committee
Pouch V
Juneau, Alaska 99811

Dear Senator Fischer:

At the request of the Senate State Affairs Committee, I am sending you a brief paper which describes our work to date in developing new economic projections for determining future electricity demand in the Railbelt.

Our work is still in a preliminary stage as all components of our projection methodology and data inputs are currently under intensive review and scrutiny both from within and without the Institute. Consequently, the projections presented in the paper are subject to change before they are actually used in a revised evaluation of Susitna feasibility.

With the caveat in mind, the paper presents our best estimate at this time of a base case (most likely) projection of economic activity. High and low projections are not yet available, but it should be kept in mind that due to the inherent uncertainties surrounding oil prices and production, as well as other variables affecting the levels of future economic activity, the range of possible futures covers a broad band.

Tables 1-4 in the paper show the 1983 preliminary projections for state population, employment, petroleum revenues, and general fund expenditures (defined to include Permanent Fund Dividends and restricted general fund expenditures). It also compares these projections to those done by the Institute in 1981 for the Battelle Railbelt study.

The significantly lower population and employment projections are the result of the downward adjustment in forecasted petroleum revenues. For the mid-1990s the most recent projections are less

than one-third those of 1981. This fall in forecasted petroleum revenues dramatically reduces state spending in the current projection below the projection made in 1981. Further, as lower petroleum revenues are a reflection of lower real energy prices, lower petroleum revenue projections go hand in hand with a reduction of the economic viability of large scale energy projections such as the ANGTS line.

Table 5 of the paper describes the revised base case economic scenario and compares it with the one used in the Battelle study. One can see the postponement or elimination of several projects, but also the addition of some new projects.

The difference between the 1981 projection and the preliminary 1983 projection is symptomatic of the uncertainty inherent in energy planning in Alaska. We cannot expect that this uncertainty has now been eliminated because a revised set of projections, albeit preliminary, has been developed. Events will continue to surprise us, forcing us to continuously change our best estimates of what the future economic picture of the state will be. Energy planning must confront this uncertainty directly and direct us toward those options which minimize the risks inherent in planning in an uncertain world.

I will be unavailable to appear before the committee on March 1, but if you desire an oral briefing on our work to date, please contact Dr. Gunnar Knapp of the Institute, who is prepared to explain in more detail the current status of our research.

Sincerely,

Oliver Scott Goldsmith/D.K.

Oliver Scott Goldsmith
Associate Professor of Economics

Enclosures

cc: Ned Lesnick, Harza-Ebasco
Robert Mohn, APA

COMPARISON OF ISER MAP MODEL PROJECTIONS PREPARED IN 1981 FOR BATTELLE RAILBELT STUDY AND PRELIMINARY PROJECTIONS PREPARED IN 1983

Prepared for

The Alaska Senate State Affairs Committee

Prepared by

Scott Goldsmith and Gunnar Knapp
University of Alaska
Institute of Social and Economic Research

February 1983

TABLE OF CONTENTS

LIST OF TABLES

I. COMPARISON OF 1981 PROJECTIONS AND 1983 PRELIMINARY PROJECTIONS

In 1981, the Institute of Social and Economic Research (ISER) prepared projections of population and economic activity in Alaska and the Railbelt for Battelle.* Tables 1-4 compare these 1981 projections for state population, employment, petroleum revenues, and general fund expenditures with the preliminary results of projections which ISER is presently preparing for the Alaska Power Authority and the Minerals Management Service Alaska OCS Office.

The significantly lower population and employment projections are the result of the downward adjustment in forecasted petroleum revenues. For the mid-1990s the most recent petroleum revenue projections are less than one-third those made in 1981. This fall in forecasted petroleum revenues dramatically reduces state spending in the current projection below the projection made in 1981. Further, as lower petroleum revenues are a reflection of lower real energy prices, lower petroleum revenue projections go hand in hand with a reduction of the economic viability of large scale energy projects such as the ANGTS line.

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*See Scott Goldsmith and Ed Porter, "Alaska Economic Projections for Estimating Electricity Requirements for the Railbelt" (ISER report prepared for Battelle, October 1981).

Our current work is still in a preliminary stage, and all of the components of the projection methodology and data inputs are currently under intensive review and scrutiny from both within and without ISER. Consequently, the projections presented in the attached tables are subject to change.

With this caveat in mind, the preliminary 1983 projections represent our best estimate at this time of a base case (most likely) projection of economic activity. We have not yet completed high and low projections, but it should be kept in mind that due to the inherent uncertainties surrounding oil prices and production, as well as other variables affecting the levels of future economic activity, the range of possible futures covers a broad band.

TABLE 1.

COMPARISON OF MAP MODEL PROJECTIONS:
POPULATION
(THOUSANDS)

	1981 PROJECTIONS	1983 PRELIMINARY PROJECTIONS	DIFFERENCE
1980	400.457	-	-
1981	412.395	415.695	3.300
1982	428.251	431.412	3.160
1983	444.492	445.441	0.948
1984	463.274	457.310	-5.964
1985	498.151	468.152	-30.000
1986	531.933	481.069	-50.864
1987	545.304	491.021	-54.283
1988	547.669	502.515	-45.154
1989	558.208	512.465	-45.743
1990	562.438	521.061	-41.377
1991	572.732	533.891	-38.841
1992	579.364	538.950	-40.413
1993	588.021	541.646	-46.375
1994	598.543	544.941	-53.603
1995	608.963	547.669	-61.293
1996	621.173	549.747	-71.426
1997	634.519	552.455	-82.064
1998	646.899	556.224	-90.675
1999	660.873	561.274	-99.600
2000	674.983	566.779	-108.204
2001	-	572.190	-
2002	-	577.875	-
2003	-	584.169	-
2004	-	590.959	-
2005	-	598.222	-
2006	-	605.880	-
2007	-	614.087	-
2008	-	622.780	-
2009	-	631.767	-
2010	-	641.297	-

NOTE: DIFFERENCE IS 1983 PRELIMINARY PROJECTIONS MINUS 1981 PRO
BLANKS INDICATE PROJECTIONS NOT AVAILABLE
SEE NOTES AT END OF TABLES FOR SOURCES

NOTE: Population projections are for long-term trends and will not capture short-term cyclical swings.

TABLE 2.

COMPARISON OF MAP MODEL PROJECTIONS:

EMPLOYMENT

(THOUSANDS)

	1981 PROJECTIONS	1983 PRELIMINARY PROJECTIONS	DIFFERENCE
1980	206.214	-	-
1981	214.193	214.217	0.024
1982	223.028	228.620	5.592
1983	233.475	234.000	0.525
1984	244.809	237.027	-7.782
1985	268.663	242.787	-25.876
1986	291.040	251.519	-39.521
1987	299.174	256.739	-42.435
1988	298.113	263.751	-34.362
1989	301.154	268.122	-33.033
1990	299.004	271.005	-27.999
1991	303.003	278.883	-24.120
1992	303.739	277.461	-26.278
1993	306.920	275.488	-31.432
1994	311.561	275.260	-36.301
1995	316.167	274.677	-41.489
1996	322.484	273.882	-48.602
1997	329.803	274.101	-55.702
1998	336.114	275.637	-60.477
1999	343.883	278.370	-65.513
2000	351.656	281.385	-70.271
2001	-	284.108	-
2002	-	286.979	-
2003	-	290.281	-
2004	-	293.862	-
2005	-	297.658	-
2006	-	301.571	-
2007	-	305.768	-
2008	-	310.155	-
2009	-	314.532	-
2010	-	319.225	-

NOTE: DIFFERENCE IS 1983 PRELIMINARY PROJECTIONS MINUS 1981 PROJECTIONS
BLANKS INDICATE PROJECTIONS NOT AVAILABLE
SEE NOTES AT END OF TABLES FOR SOURCES

TABLE 3.

COMPARISON OF MAP MODEL PROJECTIONS:

PETROLEUM REVENUES

(MILLIONS OF CURRENT DOLLARS)

	1981 PROJECTIONS	1983 PRELIMINARY PROJECTIONS	DIFFERENCE
1980	1721.020	-	-
1981	3036.738	3314.232	277.495
1982	4132.719	3964.701	-168.018
1983	5030.418	3450.448	-1579.970
1984	5598.605	3163.283	-2435.323
1985	6623.777	3388.757	-3235.021
1986	7427.629	3772.009	-3655.620
1987	8612.336	3952.286	-4660.047
1988	9549.510	4470.195	-5079.316
1989	10907.430	4713.133	-6194.301
1990	11456.360	4502.570	-6953.793
1991	12468.160	4213.605	-8254.551
1992	13032.680	4134.953	-8897.730
1993	13766.180	4049.570	-9716.610
1994	13911.120	4108.281	-9802.840
1995	13456.950	3938.794	-9518.150
1996	12864.070	3771.708	-9092.360
1997	12155.070	3927.083	-8227.984
1998	11311.730	4055.789	-7255.941
1999	10396.860	4369.531	-6027.324
2000	9559.230	4590.996	-4968.238
2001	-	4824.875	-
2002	-	5072.004	-
2003	-	5333.211	-
2004	-	5609.359	-
2005	-	5901.387	-
2006	-	6210.293	-
2007	-	6537.129	-
2008	-	6883.031	-
2009	-	7249.211	-
2010	-	7636.957	-

NOTE: DIFFERENCE IS 1983 PRELIMINARY PROJECTIONS MINUS 1981 PROJECTIONS
BLANKS INDICATE PROJECTIONS NOT AVAILABLE
SEE NOTES AT END OF TABLES FOR SOURCES

TABLE 4.

COMPARISON OF MAP MODEL PROJECTIONS:

STATE GENERAL FUND EXPENDITURES

(MILLIONS OF CURRENT DOLLARS)

	1981 PROJECTIONS	1983 PRELIMINARY PROJECTIONS	DIFFERENCE
1980	1402.121	-	-
1981	2381.692	2783.068	401.375
1982	3238.556	4000.100	761.543
1983	3582.562	3076.350	-506.212
1984	4033.220	3510.656	-522.564
1985	4556.820	3841.445	-715.375
1986	5410.379	4191.855	-1218.523
1987	6319.211	4305.965	-2013.246
1988	6915.836	4834.742	-2081.094
1989	7354.871	5063.359	-2291.512
1990	7908.508	5711.844	-2196.664
1991	8566.227	6206.945	-2359.281
1992	9202.680	5754.664	-3448.012
1993	10045.590	5810.402	-4235.191
1994	11018.460	5987.268	-5031.195
1995	12145.130	5984.492	-6160.633
1996	13389.920	5981.754	-7408.168
1997	14818.750	6268.918	-8549.828
1998	16433.000	6537.012	-9895.990
1999	18144.310	6991.930	-11152.380
2000	20107.040	7382.637	-12724.410
2001	-	7798.238	-
2002	-	8237.258	-
2003	-	8705.035	-
2004	-	9205.180	-
2005	-	9738.430	-
2006	-	10306.680	-
2007	-	10911.940	-
2008	-	11557.960	-
2009	-	12245.140	-
2010	-	12976.270	-

NOTE: DIFFERENCE IS 1983 PRELIMINARY PROJECTIONS MINUS 1981 PROJECTIONS
BLANKS INDICATE PROJECTIONS NOT AVAILABLE
SEE NOTES AT END OF TABLES FOR SOURCES

NOTE: General Fund Expenditures are defined to include permanent fund dividends and restricted general fund expenditures.

II. COMPARISON OF ASSUMPTIONS USED IN 1981 PROJECTIONS AND PRELIMINARY 1983 ASSUMPTIONS

Differences between the 1981 and 1983 projections result primarily from differences in the assumptions used. Some changes have also been made to the structure of the model; however, these are of less importance in explaining differences between projections.

Table 5 presents a brief comparison of these assumptions for the 1981 and the 1983 preliminary projections. Exogenous employment assumptions are developed by constructing a scenario of employment in different special projects and basic industries. The scenario used in the 1983 preliminary projections postponed or eliminated some projects assumed for the 1981 projections, but added others.

Table 6 compares the total exogenous employment that resulted from the exogenous employment scenarios outlined in Table 5. The significant decline in the assumptions for total exogenous employment results primarily from lower exogenous employment assumptions for the mining, construction, and transportation industries.

TABLE 5. COMPARISON OF ASSUMPTIONS, 1981 PROJECTIONS AND PRELIMINARY 1983 PROJECTIONS

	1981 Projections	Preliminary 1983 Projections
State Revenues and Expenditure Assumptions		
Revenues	Petroleum revenues based upon Alaska Department of Revenue projections published in June of 1981 (see Table 3 for projections).	Petroleum revenues based upon Alaska Department of Revenue projections published in December of 1982 (see Table 3 for projections). The income tax is reinstated in 1989.
Expenditures	Real per capita expenditures increase at the same rate as per capita income.	State expenditures are at the levels allowed by the recently-passed spending limit. In 1992 when revenues are no longer sufficient to allow expenditures at the level permitted by the spending limit, expenditures are cut to equal total revenues.
Exogenous Employment Assumptions*		
Trans-Alaska Pipeline	Operating employment continues; four new pumping stations constructed.	Operating employment continues; four new pumping stations constructed.
North Slope Oil	Long-run North Slope oil operating employment is 1,667.	Long-run North Slope oil operating employment is 2,400.
Upper Cook Inlet Oil and Gas	Upper Cook Inlet employment remains constant with gas development offsetting declines in oil production.	Upper Cook Inlet employment declines to 50 percent of current levels by 2010.
Tertiary Oil Recovery	No tertiary oil recovery assumed.	Tertiary employment in oil recovery project on North Slope utilizing natural gas peaks at 2,000 in early 1990s.
Gas Pipeline	Northwest gas pipeline constructed, 1983-87.	No gas pipeline assumed.

*Employment in different special projects and basic industries is totaled to arrive at the total exogenous employment assumptions shown in Table 6.

TABLE 5. COMPARISON OF ASSUMPTIONS, 1981 PROJECTIONS
AND PRELIMINARY 1983 PROJECTIONS (Continued)

	1981 Projections	Preliminary 1983 Projections
National Petroleum Reserve in Alaska	Slow development of 5 oil fields.	No development assumed.
Outer Continental Shelf (OCS) Petroleum and Gas	Oil and gas resources are developed in Lower Cook Inlet, the Beaufort Sea, the Chukchi Sea, & the Navarin Basin, with total employment exceeding 4,000 by 1998.	Oil and gas resources are developed only in the Beaufort Sea, with maximum employment of 1,771 in 1995.
Hydroelectric Development	No hydroelectric development assumed.	Employment in construction of hydroelectric projects peaks at 700 in 1990.
Coal Development	Beluga Coal Field developed for export.	Beluga Coal Field developed for export.
Mining	1 percent annual growth in employment	U.S. Borax, Greens Creek, and Red Dog Mines constructed; other mining employment increases at 1 percent per year.
Petroleum Refining	100,000 barrel-per-day refinery constructed at Valdez.	No new refineries assumed.
Pacific LNG Project	LNG project assumed for Anchorage area.	No LNG project assumed.
Forestry, Lumber and Pulp	Employment expands to 6,778 in 2000.	Employment expands to 4,028 in 2000.
Agriculture	Employment expands to 1,037 in 2000.	Employment expands to 508 in 2000.
Fishing	Total fish-harvesting employment expands to 7,423 in 2000. Fish processing employment expands roughly proportionately.	Total fish-harvesting employment expands to 7,096 in 2000. Fish processing employment expands roughly proportionately.
Federal Gov't Employment	Military employment constant. Civilian employment grows at .5 percent per year.	Military employment constant. Civilian employment grows at .5 percent per year.

TABLE 6. COMPARISON OF MAP MODEL TOTAL EXOGENOUS EMPLOYMENT ASSUMPTIONS

(thousands)

	1981 Projections	1983 Preliminary Projections	Difference
1980	67.010	66.152	-.858
1981	69.105	66.696	-2.409
1982	70.184	69.150	-1.034
1983	72.627	70.688	-1.939
1984	74.391	70.733	-3.658
1985	80.888	71.160	-9.728
1986	83.928	72.238	-11.690
1987	80.182	72.525	-7.657
1988	75.257	73.319	-2.208
1989	76.170	74.565	-1.595
1990	77.657	74.964	-2.693
1991	79.648	74.944	-4.704
1992	79.451	74.683	-4.798
1993	79.250	75.026	-4.224
1994	80.295	75.486	-4.809
1995	80.749	74.964	-5.755
1996	81.388	74.944	-6.444
1997	82.344	74.683	-7.661
1998	82.190	75.026	-7.164
1999	82.672	75.486	-7.186
2000	83.308	75.947	-7.361
2001	-	75.912	-
2002	-	75.816	-
2003	-	75.902	-
2004	-	75.995	-
2005	-	76.097	-
2006	-	76.152	-
2007	-	76.284	-
2008	-	76.418	-
2009	-	76.438	-
2010	-	76.598	-